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Development of the Air-hammer Rock Drill

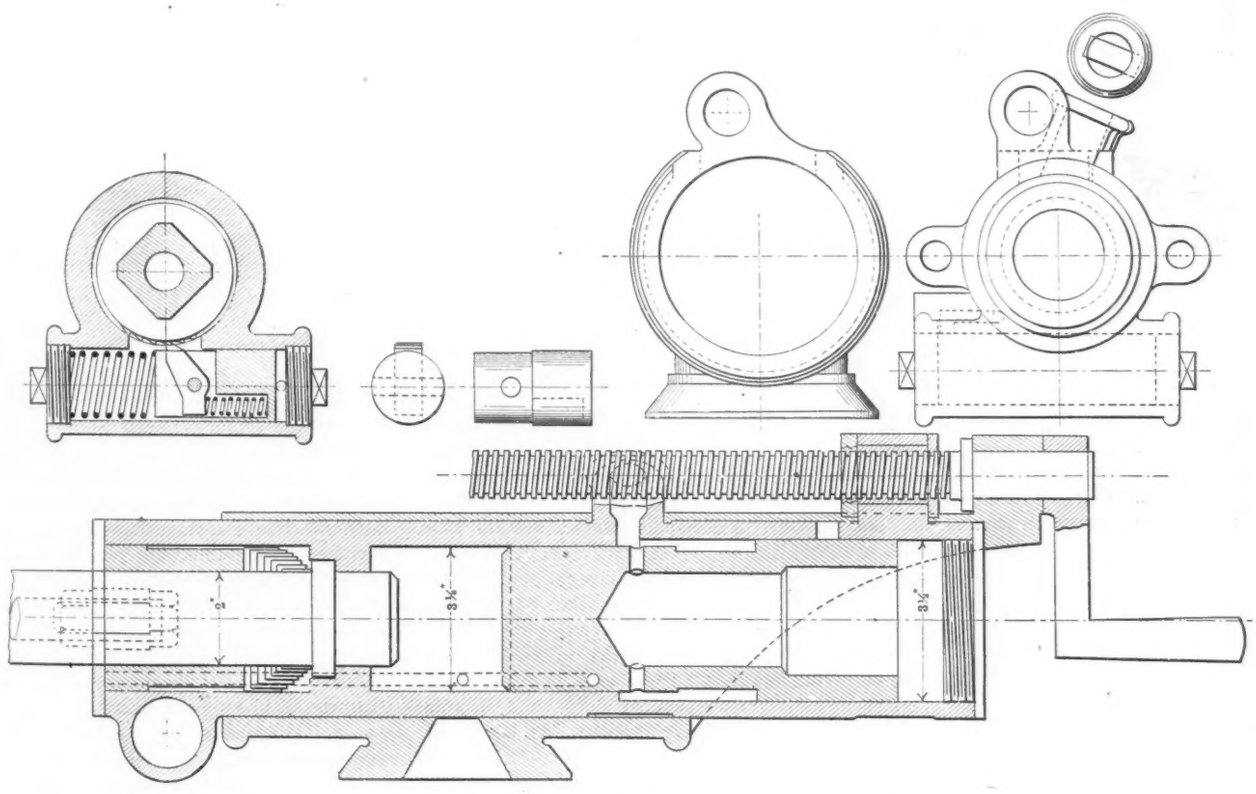
New Features of Two Machines, the Kimber and the Flottmann, Tried in the Recent Stope-drill Contest in South Africa

BY CLAUDE T. RICE

Two new air-hammer drills were tried in the stope-drill contest recently held in South Africa. These hammer drills differ considerably from any used in the United States, their design embodying several new devices. Neither is yet perfected; both gave considerable trouble during the contest; but the results attained were promising.

The Kimber Hammer Drill

The Kimber drill with a cylinder diameter of 3⅛ in., length of stroke 3 in., length of feed 1 in., weighs 100 lb. The hammer or striker is actuated without a valve on the differential piston principle, striking 800 to 1000 blows per minute. The weight of the hammer is 12 lb., in striking contrast to that of the Gordon drill, which weighs a little over 1 lb. The construction will be easily understood from the accompanying illustration.



KIMBER AIR-HAMMER DRILL

The rotation of the drill steel is effected by a small cylinder cast on the front end of the main cylinder and at right angles to it. To the piston of this cylinder is attached a pawl, which engages with a ratchet wheel. This ratchet wheel has a square hole through the center to receive the chuck on which the blow is struck. The square part of this chuck is made a sliding fit and is allowed to move longitudinally as the blows are struck, while the ratchet wheel gives the turning movement. The small piston is driven forward by means of air, admitted to one end and governed by ports communicating with the main piston and is driven backward by a spring. The arrangement is such that for each blow, the drill steel makes 1/20 of a revolution. The cradle is cylindrical in shape, with a slot at the top side, which fits a lug cast on the cylinder and forms a slide. The feed is obtained by means of a screw and nut, with a crank handle attached in the ordinary way. The machine is simple in design with few working parts, but it is at present only in the experimental stage, the machine which competed in the recent stope-drill contest on the Rand being the first built.

The performance of the drill in the contest should not be criticized severely, for troubles were common; besides each competitor was allowed the use of a spare machine; in the case of this drill neither a spare machine nor spare parts were available. Hollow steel was used with air delivered to the bottom of the hole through the center. The operator could obtain suitable steel in 2-ft. lengths only, and consequently, had to resort to welding the parts. This proved unfortunate, for on one occasion the steel broke at the weld, and on another, a steel broke in the hole and could not be removed.

Constant trouble was experienced by reason of the steels sticking in the holes, and considerable time was lost for this reason. Toward the end of the second day's trials, the chuck which had not been

NOTE—Based on a paper entitled, "Stope Drills," by J. Orr, in *Proceedings* of the Transvaal Institute of Mechanical Engineers, Jan. 1, 1908.

case-hardened, practically gave out. Using hollow steel this machine was more successful on the horizontal holes than any of the solid steel machines.

This machine drilled at the rate of 1.09 in. per min. of actual drilling time at 50-lb. pressure, and 1.71 in. per min. at 60-lb. pressure.

Flottmann Hammer Drill

This machine also differs in many essential respects from most hammer drills now on the market. It has a cylinder diameter of 2⅜ in., a length of stroke of 1¾ in., a length of feed of 24 in., and a weight of only 52¼ lb. It is made entirely of forged steel, all the wearing parts being hardened and ground to gage.

The cylinder, which is made of a solid forging, holds in its upper part the maker's "ball valve gear" with a tap for the introduction of the air. The thinner part of the piston is provided in its back part with twisted grooves for the twist nut, and, on its front part, with straight grooves for the guide nut. The ratchet case fits, with its thinner part, into the cylinder, and is provided with two notches which hold the pawls with the push pins and the springs. The twist nut of phosphor-bronze is screwed into the ratchet wheel which fits into the cylindrical front part, and the drill holder takes in its upper part the phosphor-bronze nut. The turning movement of the piston in its backward stroke gives rotation to the drill. The lower part of the drill holder is provided with square holes into which the drill fits. The machine is also fitted with an air feed which consists of two steel tubes, ground to gage by special machinery. On the back portion of the air feed there is a valve for regulating the air pressure as required.

In the drill competition this machine was troubled by badly tempered steel and by the breaking of the clamps, both on the arm and the machine. For drilling dry holes this machine used hollow steel through which the air was exhausted, a hollow hammer being substituted during the test. This greatly increased the speed of drilling. The great length of the drill, 6 ft., makes it awkward to carry in a stope. At 50-lb. pressure the Flottmann drill drilled 1.43 in. per min. of actual drilling time and 1.74 per min. at 60-lb. pressure.

Changes in Iron Ore Shipping Piers

Special Correspondence

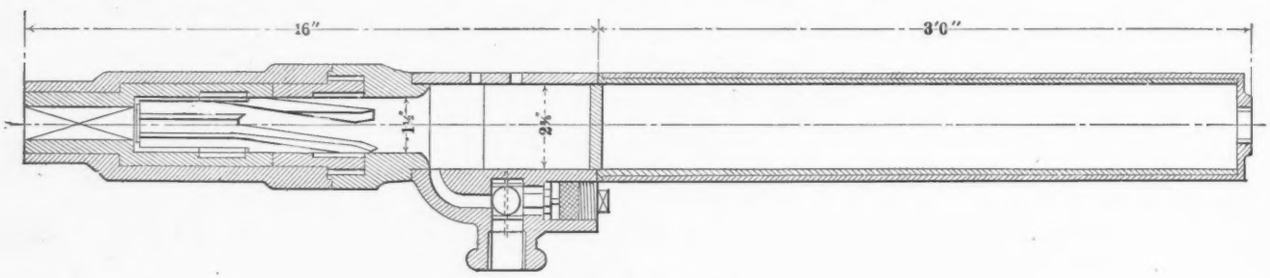
Comparison of the records of Lake iron ore shipping piers on May 1, 1908, and the same date a year ago, shows the addition of No. 6 pier of the Duluth & Iron Range road, an all-steel pier, having a capacity for storing 37,360 tons, and for shipping probably 1,500,000 tons in a lake season; the rebuilding of No. 2 dock of the Chicago & Northwestern railroad at Ashland, adding 16,380 tons to its capacity; and the loss of No. 1 dock of the Duluth, South Shore & Atlantic railroad, at Marquette, reducing the road's storage by 27,000 tons. Of these changes that first mentioned is by far the most important, as it is the initial attempt to use steel construction in ore piers in the United States.

Soon after shipments begin this year, there will be a total capacity on the upper lakes for the storage of 1,327,083 gross tons of ore at one time, in the various docks scattered from Duluth to Escanaba. All of these are on Lake Superior except those of the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul railroads, at Escanaba, on an arm of Lake Michigan. These docks number 24, and have a total of 6192 pockets, giving an average storage per pocket of 214 tons. Ten years ago the average capacity of pockets at all ore docks on the lakes was but 149 tons. The change in hight, width, and construction of docks and in total storage shipping capacity has been fully as marked. At that time the annual shipments of iron ore from the upper lakes amounted to 14,000,000 tons; now it is 42,000,000 tons. Then the largest ships carried cargoes of about 3500 tons; now they carry 13,000 and are correspondingly longer and higher. It is the addition to the sides of vessels that has brought about the raising of docks from a maximum of 59 ft. to 73 ft. at the present time.

For the distinctively Mesabi trade there are now 10 docks, with a total capacity for storing about 550,000 tons; providing there is an ample supply of vessels, etc., about 40,000,000 tons can be shipped during an average season. Of the three roads serving this range the Great Northern has the largest capacity, although its shipments have been less than either of the others. The road has three docks of a total capacity of 283,500 tons, and of an average pocket capacity of 280 tons each. This is also the highest average for any dock system on the lakes. These three docks are all 73 ft. high, 62.8 ft. wide, and have 33 ft. of pocket hight; they have a combined loading frontage of 12,600 ft. Ten thousand tons of ore have been loaded into a ship at these docks in less than 90 minutes. Next to the Great Northern is the Chicago & Northwestern, with its two terminal systems, one at Escanaba and the other at Ashland, for Menominee and Gogebic ores. It has no less than seven docks of a total capacity of 275,523 tons. Following this are the two roads of the United States Steel Corporation, the Duluth, Missabi & Northern with 269,034 tons and the Duluth & Iron Range with 225,770 tons.

The Chicago & Northwestern road has rebuilt its No. 2 Ashland dock this spring, raising the structure 12.2 ft. and increasing its capacity by 16,380 tons. Because of the increasing size of ships, the No. 1 dock of the Duluth, South Shore & Atlantic was destroyed. This dock was only 25 ft. from water level to the bottom of the pockets and 45 ft. over all. Theoretically, the road's storage capacity was reduced by 27,000 tons, but practically not at all, for a dock of that hight is unavailable for modern lake shipping.

The various shipping piers at upper lake ports, designed for iron ore and useful for no other traffic, represent an investment of about $15,500,000, and give a seasonal shipping capacity of about 50,000,000 gross tons.



FLOTTMANN AIR-HAMMER DRILL

At Castle, Mont., lead ore occurred in chimneys in limestone and at the contact of limestone with igneous rocks. The ore, which was carbonate and sulphate, with oxide of iron, and gangue of silica, was oxidized to an unusual depth. The principal mines were the Cumberland and the Yellowstone. The former had a small smelting works at Castle. The high cost of transportation to Livingston (75 miles distant), the nearest railway point, retarded the development of the district and operations were finally suspended in 1893.

Short Talks on Mining Law—II

By A. H. Ricketts*

A valid location having been made the possessory right thereto is preserved from adverse mineral location (but not from agricultural entry) for the remainder of the calendar year of location. At some time during the next calendar year and each year thereafter, until the Government is paid for the land in patent proceedings (unless the title has passed to an agricultural claimant), at least $100 worth of labor must be done or $100 worth of improvements must be made either upon or off the claim, or upon one of a group of claims. In the latter case the aggregate amount must equal that required for each separate location, whether lode or placer, and must tend to the development of all the claims within the group.

The term "labor" is used in the mining act in the sense of mining work intended for the development of the location, and the term "improvements" as a "tangible, material addition to the claim for the purpose of developing the property and extracting the minerals therefrom."

The amount of the annual expenditure which is also termed "annual labor," "assessment work," or "representation," may be increased, but not diminished, by local statute or local rule. In some States an affidavit in a prescribed form may be recorded within a specified time and furnish *prima facie* evidence of the performance of the assessment work.

It is not, however, the mere payment of the statutory amount within the statutory period, which will satisfy the requirements of the mining act in relation to such expenditure. Nor can any arbitrary rule be laid down, as is attempted in some States, by local legislation or local rule as to the character or amount of work, which shall constitute the same. The test is, what is the reasonable value of the work, and not what was paid for the work, and also whether the work done tends to develop or improve the claim. Payment is not conclusive proof of these facts, although the outlay made may be an evidence of good faith.

Consequently, if the work done upon the surface of a location does not tend to improve or develop the claim, it will not hold the claim from re-location, although it may equal or exceed the statutory amount. For instance, the construction of a flume to carry water to a claim may tend to its development and therefore be a sufficient compliance with the mining act, but the building of a flume to carry away waste material therefrom would not have that effect and therefore would not be applicable as assessment work, no matter what its cost.

No work done during the first calendar year of location is effective as "holding work," under the mining act, but may be required by local statute or local rule but $500 worth of work may be done within that time, and this work form a basis for an application for patent. In fact there is nothing in the law to prevent the making of a location on one day and of an application for patent the next day, for the doing of said amount of work or making improvement of sufficient value within the 60 days' period, required for newspaper publication of the notice of intention to apply for a patent, would be sufficient. Assessment work can be counted in patent proceeding, for any work that can be counted for assessment work, is of such a nature that it is applicable toward patent.

Forfeiting Right to a Mining Location

Failure to make the requisite expenditure does not of itself forfeit the claim. "Work" may be "resumed" upon the last day of the year in which it is due, or at any other time thereafter before adverse location. To "resume" work is to actually begin work with the intention, in good faith, to prosecute it to completion.

Possession for the statutory period, or longer, in the absence of an adverse claim, will entitle the claimant to patent without the making of such expenditure. But to obtain the patent it is necessary that at least $500 has been expended upon the property in labor or improvements. Mere naked possession does not, however, prevent peaceable re-location or agricultural entry.

The burden of proof is cast upon the party who asserts that the claim has been forfeited. Forfeiture in the sense here used never takes place until the expiration of the calendar year in which the expenditure is due.

Abandonment may take place at any time. The latter is a question of intention evidenced by desertion of the claim without intention to return thereto, or by conveyance to the United States. In either event the claim is open to re-location at once, for abandonment operates instantly and extinguishes all rights of the owner.

If the required expenditure is made by say one of several locators or co-owners, the rights of the others are not forfeited to him who has done or made the same, until he follows the course provided by the mining act; that is, to "advertise" them out.

The "Advertising Out" of Partners

The "advertising out" of coöwners may be done by publication or personal service of a demand for contribution. The provisions of the act are generally amplified by local legislation which should be strictly pursued, for the proceedings involve title to real estate and a forfeiture is always odious to the law.

Payment for the land embraced in the claim in patent proceedings obviates the necessity for further annual expenditure thereon, if the claimants' acts therein are free from fraud against the Government.

No annual expenditure is required upon a mill site or tunnel location under the mining act, but the mill site must be appropriately used, and work must be diligently prosecuted on the tunnel. Cessation of work on the latter for six months may forfeit the right to the tunnel location.

It has been held that a re-location is fraudulent when made by one who has failed to comply with the requirements of the law relating to the annual expenditure. But the decisions are not harmonious upon this point.

The Notice of Location

A notice of location occupies an anomalous position in the law. It is not required by the mining act that it shall be either posted or recorded. That is left by the act to local legislation or local rule with the proviso, however, that, if recorded, it shall contain the name of the locator, the name of the lode (or claim, if placer), the date of the location, and an intelligible reference to some natural object or permanent monument, which may be sufficient to identify the claim, and which may be situated on or off the claim.

Hence a location, in some cases, may be valid without either the posting or recording of a notice of location. In other cases, the posting or the recording of such notice or both these acts may be essential parts of the location, and if the reference to the object or monument is not a sufficient tie, the location may be void. The posted notice and the record, as the act of recording is sometimes called, are without effect unless required by local statute or local rule. The record in some places is made *prima facie* evidence of certain prescribed recitals, and the record is void if it lacks certain recitals or any one of them. If the introduction of the record in evidence is not objected to or the location is not attacked in the land department, the record, whether the recording of the claim is, or is not required, may be used as presumptive evidence of discovery, of the marking of the boundaries, and of the existence of the object or monument therein referred to as said tie. But if the facts of the location are questioned at the proper time, these must be proved in the way that facts are ordinarily proved in a court.

The Value of the Record

The record, strictly speaking, is merely the foundation of the paper title to the claim. This must be true because a putative paper title may exist without any

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location having in fact been made upon the ground. If the claim is staked, the record does not prove that the land embraced therein was then subject to location either in whole or in part; or that the location is based upon a sufficient discovery; or that it was so marked that its boundaries can be readily traced; or that the natural object or permanent monument, therein referred to, exists at all, or that the reference thereto can serve to identify the claim.

Indeed it has been held that the record does not prove more than its own recordation. As far as the location itself is concerned, that may be the better rule, but the record may also be valuable evidence of the respective interests of the co-locators; these interests would be *pro rata* unless otherwise specified therein.

It may therefore be said that, while the record gives no vested title as against the United States, it is evidence of title between those claiming thereunder, and has at least the weight of an agreement between the co-locators and their grantees.

So while the record is the basis of an abstract of title of an unpatented mining claim, and, taken in connection with the other instruments contained therein, may in a sense show a title fairly deducible of record, still, as a fact, it shows only the chain of putative title, and is silent as to the validity of the location, or the absence of overlapping or conflicting claims, or of possible litigation by adverse claimants to the whole or part of the claim. These facts it may be said rest on *parol* evidence and personal examination.

An abstract of title to a patented claim is more satisfactory, as while the location notice is still the basis of the paper title, the patent removes the doubts existing in the other case, because, as said before, the patent (unless the subject of direct proceedings for its annulment) is conclusive evidence of all the facts essential to a valid location, and proves that no surface conflicts exist; but still the patent does not necessarily show that the patentee is solely or possibly at all entitled to the land described therein. For instance, he may be adjudged by a court of equity to be the trustee for one or more persons, who may be equally entitled to a part, or, perhaps, better entitled to the whole of the premises as co-owners or otherwise.

The lapse of a given time or the sale to a *bona fide* purchaser will bar action by an individual or the Government against a patentee or his grantees.

There is a greater difference between the rights attaching to an unpatented and a patented claim than is generally supposed. Some of these, at least, will be pointed out herein.

The courts broadly state that a valid location is "a grant and property in the highest sense of the term," although the incidents of ownership are not the same in both cases, as has been pointed out in subsequent decisions by the court which first enunciated that doctrine. It seems safe to say that there is a "grant" only when patent actually issues, because until then the fee remains in the United States and a person holding under a mere location may be compelled, at any time prior to patent, to give way to an agricultural claimant; that is, to one who establishes as a present fact that the land is more valuable for other purposes than it is for mining.

Indeed the administration of the land laws is such that it sometimes happens that the owner of a valid location is divested of his right on *ex parte* proceedings by the fact that the land has been patented to one claiming it to be nonmineral land. How, then, can a location be a "grant" so long as the title thereto is subject to controversy between rival claimants under different laws?

A valid location may be in the nature of a grant but it would scarcely seem to be a grant, for it gives no vested right to the land and the paramount title may still pass to another.

It would seem that such a location is little, if any, better than a license to occupy a chosen part of the lands belonging to the United States and is dependent for its existence upon the doing of certain acts until patent issues to its claimant, or to an adverse party. It certainly does not divest the title of the Government and while deemed "property in the highest sense of the term," that is, real estate, it is not given all the characteristics of the same. For instance, it is not subject to taxation (because it belongs to the United States), but the possessory right and the product of the mine (if it has become such) may be subject to taxation under the State law. It is not common property, for it is not subject to the right of dower, nor is it subject to the lien of a general judgment imposed on real property.

The Patent

The patent is the evidence of a perfected right to the land described therein, and its issuance thenceforth subjects such land to all local legislation relating to other real estate. The patent confers no additional mining rights, but it fixes the surface boundaries beyond a doubt, and relieves the patentee from further annual expenditure.

It is purely a matter of self interest as to when the mineral claimant shall, if at all, take steps to obtain a patent for his claim, although in a way such a course may be forced upon him by adverse proceedings. For instance, *A* may apply for patent for a claim to which *B* lays adverse claim in whole or in part. *B* must resist such application by filing an adverse claim containing the matters required by law, in the local land office, and follow that by commencing suit in a court of competent jurisdiction, and prosecute the same with due diligence to final determination or else waive his right. If successful in such suit, he might as well file the judgment roll and proof, required by law and the regulations of the land department, pay for the land, and receive his patent. That is, provided the land department is satisfied that he is entitled to the land. This presents no conflict of authority, as the courts can only pass upon the question of the right of possession between adverse claimants to the land in dispute, while the land department, as the guardian of the public lands, has the exclusive right to determine whether he is entitled to obtain title from the Government.

Minas Pedrazzini Gold and Silver Mining Company

The Minas Pedrazzini Gold and Silver Mining Company produced in 1907, 928 tons of first-class ore, and 4232 tons of second-class ore. In addition to this, 955 oz. of picked sulphide of silver were separately shipped. The second-class ore milled during the year amounted to 3286 tons, which gave 179 tons of concentrate and 23,387.4 oz. of bullion. Proceeds of ore and concentrates amounted to $358,467; from bullion, $12,353; estimated proceeds of ore and concentrates in transit, $55,703; estimated proceeds of bullion, bars and sulphide in transit, $3853; total, $430,375. The second-class ore on hand, amounting to 997 tons, is estimated to be worth $34,888, or $35 per ton. During the year the development amounted to 655.5 ft. of crosscuts, 1618 ft. of drifts, 450.5 ft. of raises, 337.5 ft. of winzes, 372 ft. of shafts; total, 3433.5 ft.

Construction and surface improvement included a number of dwellings and mine buildings and also a large storage reservoir from which was laid a 4-in. spiral-rivetted pipe line, about 2500 ft. long, to take the mine water to the mill. At the San Gotardo mill a new Wilfley concentrator was added and an additional amalgamating pan was being built. At the close of the year wages were reduced about 7 per cent. in order to compensate for the decreased price of silver. The miners accepted this reduction as inevitable and no trouble ensued.

It is stated that grading has already begun on the extension of the Cananea, Rio Yaqui & Pacific Railroad from Nacozari southward toward Cumpas, which will pass within about 30 miles of the proposed terminal of the cable tramway which the company expects to put in to carry fuel and ore shipments. It is estimated that 1500 tons of first-class ore, worth $600,000 and 7400 tons of second-class ore, worth $259,000, are in sight.

The American Mill at Oronogo, Joplin District

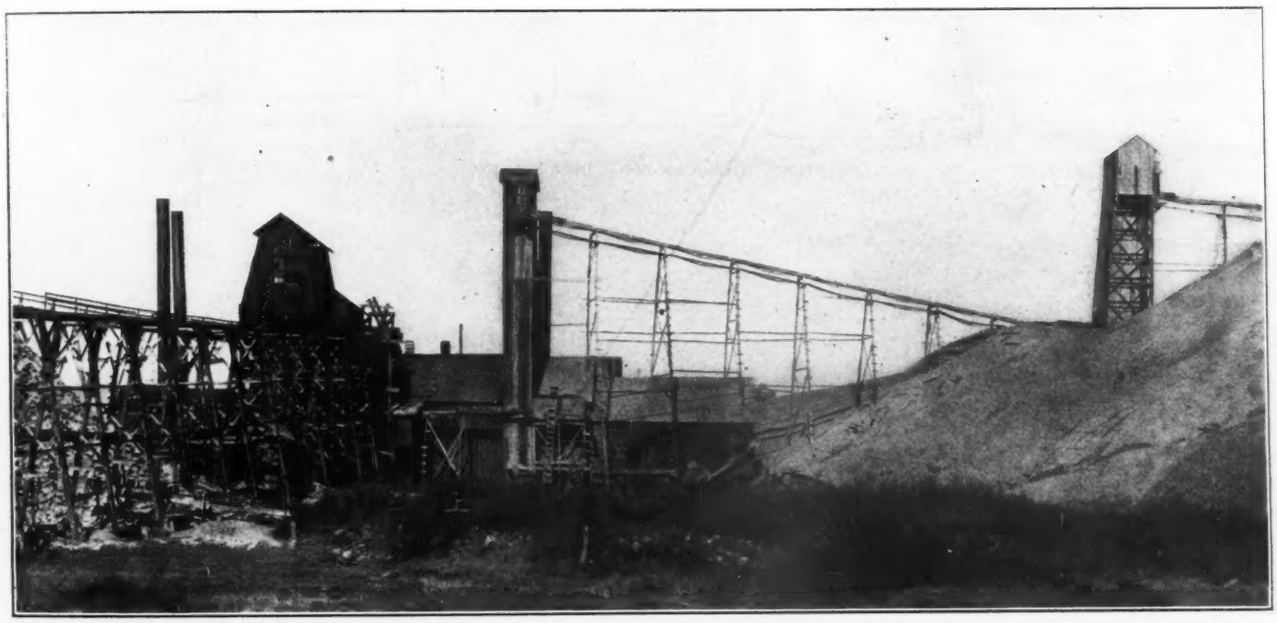
A Typical Plant for Concentrating Sheet-ground Ore but Differing in Some Essential Details from Practice Prevailing at Joplin

BY DOSS BRITTAIN*

One of the typical sheet-ground mills of the Joplin District, Mo., and yet one which in some respects offers a peculiar example of ore concentration, is the American mill of the American Mining and Smelting Company, at Oronogo. This mill was built in 1904 by the Freeman Foundry and Manufacturing Company, of Joplin, and since that time has been running continuously. It is of 200-ton capacity and handles ore from the sheet formation at the 170-ft. level. The ore deposit differs slightly from the typical sheet ground in carrying a higher percentage of ore, and in the fact that the percentage of lead is almost or quite equal to that of zinc. This fact rendered it necessary to introduce some slight changes in the milling practice common to sheet-ore concentration.

The power plant of the mill includes the following equipment: Two boilers of 150 h.p. each; a 14x20-in. Atlas engine for operating the mill; a 635-cu.ft. Laidlaw-Dunn-Gordon air compressor for driving the machine drills; and an 8x10-in. Sampson hoist. The mill is lighted with electric current generated by a 36-amp. dynamo driven by a 15-h.p. Crescent engine.

The equipment for ore concentration consists of an ore hopper 16x16x16 ft.; a 15-in. Webb City crusher; one set of 30-in. dirt rolls; two sets 24-in. rolls; one set 14-in. chat rolls; Cooley jigs, a rougher containing six cells, 32x36 in., with ⅜-in. grates; a cleaner containing seven cells, 28x36 in., the sieves consisting in the first and fourth cells of wire cloth with 1/5-in. meshes and the others of 1/6-in. meshes; a four-celled sand jig and a Kirk concentrating table. The operation of the sand jig has been eliminated, as it is thought that concentration can be carried on as well without it and its labor and expense of operation. A centrifugal pump with 6-in. suction and 5-in. discharge pipes supplies the mill with water for washing purposes.



AMERICAN MILL, AMERICAN MINING AND SMELTING COMPANY, ORONOGO, MO.

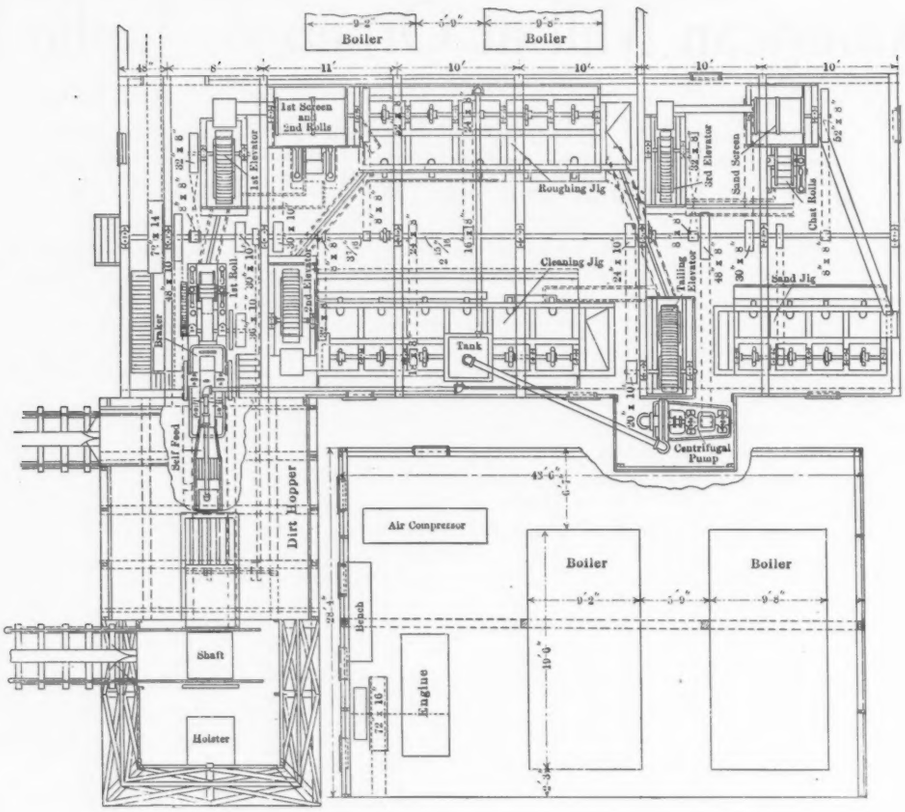
Course of the Ore Through the Mill

From the hopper the ore passes directly to the crusher. Later practice has introduced a grizzly having ¾-in. spaces to reduce the quantity of fines as much as possible. From the crusher the ore passes to 30-in. rolls, which in later practice have been superseded by 36-in. rolls. The first elevator then carries the ore stream which is divided in the discharge of the elevator, to two 36x72-in. trommels with ⅜-in. screens. The oversize is reground on 24-in. rolls and is returned to the 20-in. first elevator. The undersize from the trommels passes to the rougher from which the tailings, consisting of coarse, barren gangue with ¼ in. as the smallest dimension, are elevated out of the mill by the 12-in. tailing elevator, which later practice has replaced in other mills with a 16-in. elevator. As this mill has been in operation steadily for the past three and one-half years, the erection of a second, "dummy" elevator, to re-elevate the tailings from the foot of the discharge of the first was made necessary in order to avoid the necessity of increasing inconveniently the hight of the first.

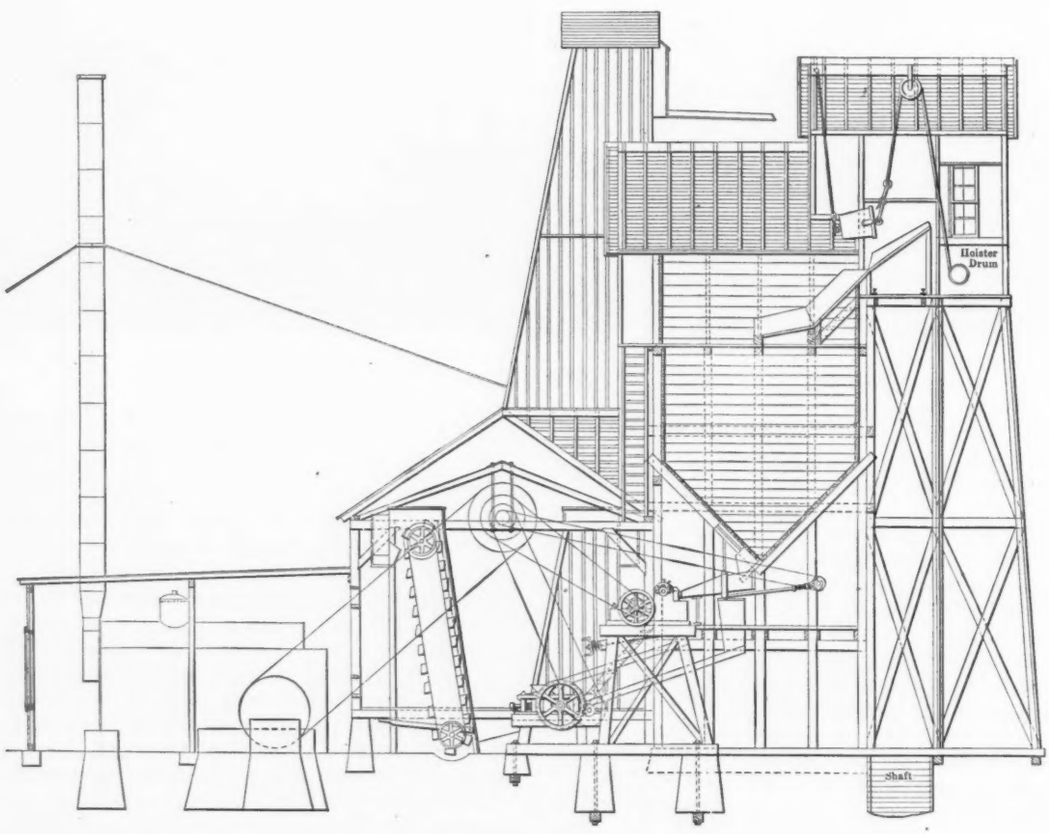
The overflow from the rougher consists of excess water, fine sand, and the "fines," the very finest particles of ore, both lead and zinc, fine enough to float; this passes into a settling tank outside the mill.

The "hutch" from the jig consists of both lead and zinc ore and sand, the mixture being called "smittem"; it passes to a 14-in. smittim elevator which dumps the ore into a cleaner jig. The "bedding," termed by some the "middlings," from the grate of the jig goes to a 12-in. chat elevator and is reground by a set of 14-in. chat rolls whence it passes to a ⅛-in. chat screen, a 30x48-in. trommel. The over-size is re-elevated and passes again through the rolls and screen. The undersize passes again to the first elevator and finally is re-treated on the rougher, a second treatment being necessary because the bedding ore consists of particles of ore still clinging mechanically to particles of gangue. These particles are also larger

*Joplin, Mo.



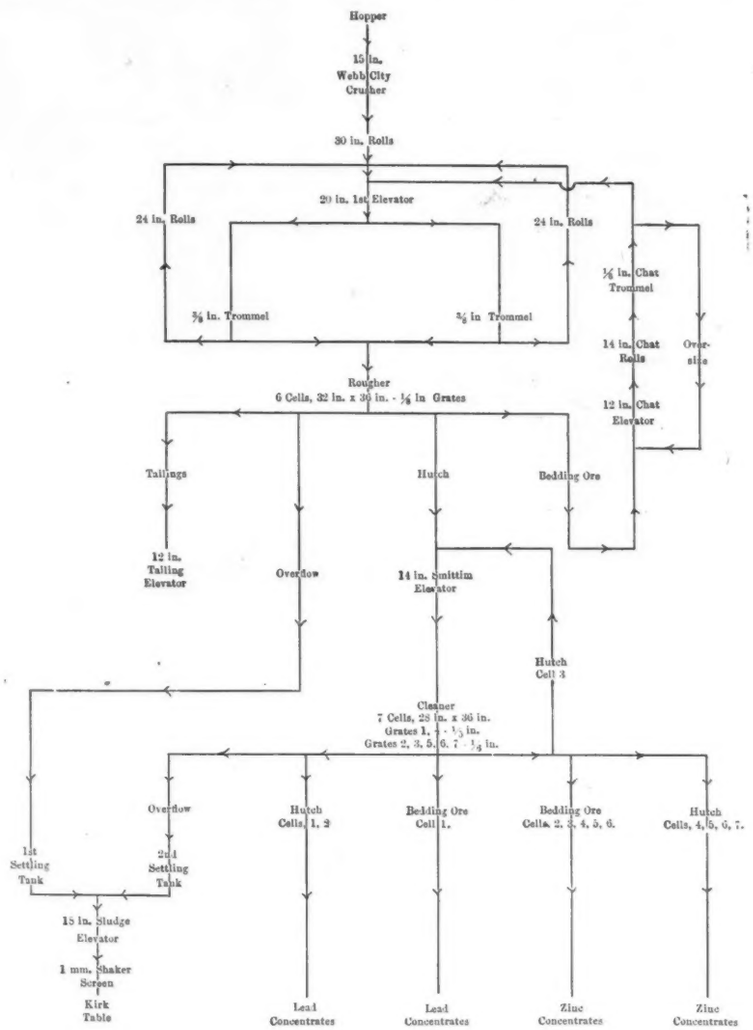
PLAN, AMERICAN MILL, ORONOGO, MO.



SECTIONAL ELEVATION, AMERICAN MILL, ORONOGO, MO.

than conducive to satisfactory separation and contain enough ore to carry them below the level of the tailings, but not enough to bring them down with the hutch; they are usually larger than the required ⅛-in. smallest dimension. Being re-crushed and re-screened to the ⅛-in. size the second passage over the rougher makes some final disposition of them.

As the hutch from the rougher is carried by the smittem elevator to the cleaner jig the process of obtaining concentrates begins. The overflow passes to a second settling tank situated on the side of the mill opposite from the first and in all respects its duplicate.



FLOW SHEET, AMERICAN MILL

From the settling tanks the water returns to the mill pond, through an orifice near the top of the tank. The fines from both tanks join and passing over an 18-in. sludge elevator, are screened through a 1-mm. shaker screen, the over-size passing out as tailings, the under-size being cleaned on a Kirk concentrating table.

The hutch from cells Nos. 1 and 2 consists of lead concentrates, also the bedding of cell No. 1. The latter concentrates are so coarse that it has been found more convenient to shovel them into the ore-trough rather than draw them off automatically through gates. The bedding ore from all but the first cell is drawn off as very coarse zinc concentrates while the hutch from the last four cells also comes down as zinc concentrates. The hutch from cell No. 3, called the "idler," because it produces no concentrates, passes back to the smittem elevator, and is re-treated on the cleaner. The hutch from the idler, not being far enough down the jig for all the lead to have been eliminated, consists of the lighter particles of lead and the heavier particles of zinc. A second treatment effects their separation.

Unusual Features

The features of the American mill which differ from those of many other mills operating under similar conditions are the rolls, the screening, the elimination of the sand jig, and the grates of the rougher. In the mills now being erected the first set of rolls, "the dirt rolls," is invariably of the 36-in. type. Rolls of this dimension are capable of crushing for a 250-ton mill without becoming choked. The installation of 30-in. rolls at the American mill is now recognized as having been inadvisable. They not only become choked, but they are operated so far apart that two sets of 24-in. rolls are made necessary for completing the work that one set should accomplish. Instead of returning the ore stream, consisting of the oversize from the first trommels, to the first set of rolls, it is passed to others, making in this case the operation of three sets of rolls necessary where at most two sets of 30-in. rolls would do the work better and would require less power for operation and outlay for hard iron.

The operation of two trommel screens with larger dimensions than those ordinarily used is a commendable feature at the American. Ordinarily one screen is used with ¼-in. perforations, while those of the American have ⅜-in. perforations. The increase in the number of screens and the size of the perforations for handling the ore from the first sets of rolls prevents crowding and renders the work in all respects more satisfactory. Most mill men in the district expect too much of the screens, and poor sizing, and consequent waste of ore, is the result. The type of screen installed in the American mill more than three years ago has maintained its reputation for efficiency, and throughout the district, in spite of recommendations to the contrary, the trommel screen prevails.

While the ore thrown into the rougher is ⅛ in. larger in its smallest dimension than usual in sheet-ground mills, and while it would seem that there would be a larger waste in the tailings on acount of the larger particles of rock being able to carry over small particles of ore clinging to them, such is not the case; much attention is given to the direction of the bedding ore to the chat rolls, which, differing from the chat rolls of the ordinary mill, are called upon to operate more nearly up to their capacity, grinding to ⅛-inch size and accomplishing more completely the desired results where the initial ¼-in. screening is a part of the concentration.

Tables or Sand Jigs?

The third feature of difference, the elimination of the sand jig, seems like a reversion, but the contrary is the case. In the older types of mills only the rougher and the cleaner were operated; this practice continued until recent years. Then sand jigs were installed, and no mill was considered well equipped without them. Tables followed as an additional improvement, and were operated in connection with the sand jigs to save the fines. Milling practice at the American mill, however, differs from accepted usage in requiring the table to do the work formerly done by it and the sand jig together. This change is made possible only by the fact that the Kirk table is especially adapted

for handling the coarse fines and in very large quantities.

The fourth and last feature in which the practice at the American mill differs from the ordinary is in the sieves of the cleaner. Those for cells Nos. 1 and 4 are made of wire cloth of 1/5-in. mesh and those of the others 1/6-in. mesh. Ordinarily for both roughers and cleaners cast-iron grates are used, while wire cloth is reserved for the sand jigs only. In this case, also, the sieves of the cells are provided with screens of different mesh. The advantage claimed for this system is that the larger particles of lead are allowed to pass through into the hutch in the first cell, thus at once relieving the ore stream of a large amount of coarse matter. As the coarser particles of zinc ore do not come down in the first cell, but do to some extent by the time the second is reached, the finer mesh of 1/6 in. prevents their going through into the lead concentrates of cell No. 2 and into the smittim of cell No. 3. If they did pass into the smittim they would again pass over the cleaner and be as troublesome in the second passage as in the first. The presence of the coarser mesh in cell No. 4, however, allows the coarsest zinc ore which has been gathering at the sieves during its passage of the first three cells to pass at once into the hutch, relieving as in the case of the coarsest lead, the ore stream, of the coarsest matter. This leaves the remaining three cells of the cleaner with nothing to clean but the medium and finer particles of ore.

Colorado Metal Production

The advance statement of Commissioner of Mines T. J. Dalzell gives the production of metals from Colorado mines in 1906 and 1907 as follows:

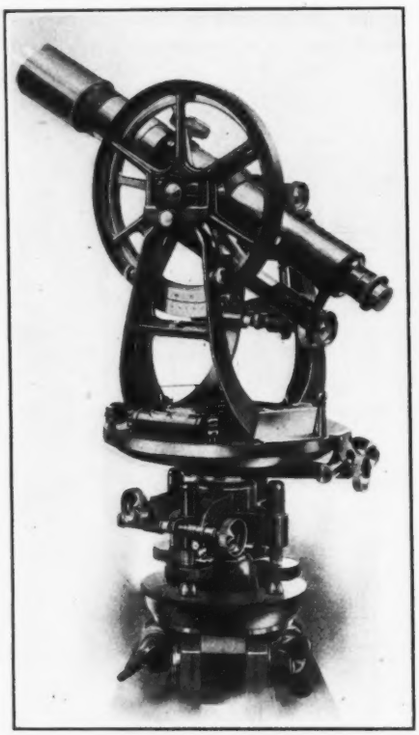
	1906.	1907.	Changes.
Gold, oz.....	1,092,827	990,398	D. 102,429
Silver, oz.....	12,725,882	12,059,202	D. 666,680
Lead, lb.....	105,984,540	92,987,235	D. 12,997,305
Copper, lb.....	9,565,319	11,250,291	I. 1,684,972
Zinc, lb.....	85,488,901	85,018,157	D. 470,744

The zinc is figured on actual spelter recovered. In addition to the metals given, 1200 tons of tungsten ore, all from Boulder county, were reported in 1907.

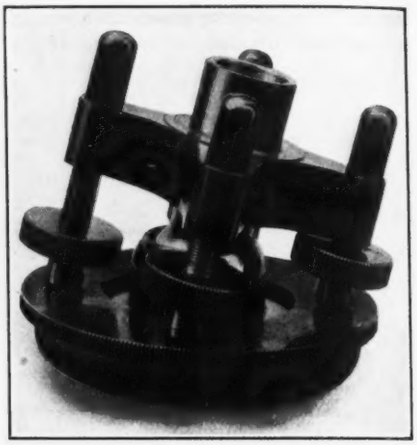
The production is stated by counties in the report. The larger gold producers in 1907 were Teller (Cripple Creek), 501,707 oz.; San Miguel, 119,240; Ouray, 118,497; Lake, 53,982 oz. The chief silver producers were Lake (Leadville), 4,604,480 oz.; Pitkin, 1,693,477; San Miguel, 1,490,770; Mineral, 1,246,961 oz. The large lead producers were nearly the same, Lake county reporting 34,064,162 lb.; Pitkin, 13,914,993; Mineral, 12,980,288; and San Juan, 12,425,828 lb. The large producers of copper were Lake county, 5,366,759 lb., and San Juan, 2,572,764. The chief zinc production was 67,247,381 lb. from Lake, and 4,688,693 lb. from Pitkin county.

The Ainsworth Theodolite

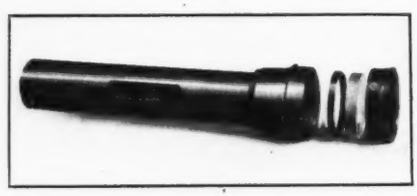
A new theodolite recently designed by William Ainsworth & Sons, of Denver, Colo., has a 10-in. 25-power telescope with a 1¼-in. objective, 5-in. full vertical circle, with guard and vernier reading to 1 min. 30 sec., and telescope level. There are also stadia wires, gradienter, a 5-in. limb with verniers reading to 1 min. at a 30-deg. angle with the telescope, and a 2½-in. compass.



COMPLETE AINSWORTH THEODOLITE



THEODOLITE STANDARD



TELESCOPE

For rigidity and permanence of alinement the U standard is noteworthy. All clamps and tangents are of the gib type, which, when properly constructed are superior to the split clamps formerly used, because they do not carry the instrument off the line when clamping.

The principal parts of the instrument are made of the hardest bronze alloys to limit gages and are interchangeable; the makers guarantee that any of the parts excepting the limb, vernier plate, and centers can be interchanged with other of their instruments of the same size without throwing the instrument out of collimation to exceed 15 seconds.

One of the advantages resulting from the use of gages is shown by the leveling head, which cannot be cramped in any position. Usually when leveling up an instrument it is necessary to loosen all four of the screws to prevent cramping, but this is not the case where all parts are made accurately to gages and carefully inspected after each operation and before assembling.

Another feature of this instrument is the telescope construction wherein accurate limit gages also play an important part. The main telescope tube is finished inside and out by lapping, as is also the outside of the draw tube to within 0.0001 in. of standard dimensions. The inside of the objective head, the outside and inside of the lens cell and the periphery of the objective are all of uniform diameter.

English syndicates, formed chiefly in London, for working mines in Russia—chiefly gold mines—are very numerous, and, apparently, have a tendency to increase. Many have already been registered in Russia—i.e., are allowed by the Government to operate in Russia—but only a few have really started business.

The total production of coal in Prussia in 1906 was 128,295,948 tons, 61.36 per cent. of which was produced in the Ruhr coalfield and 23.12 per cent. in Upper Silesia. The output for the Kingdom was 274 tons per miner, for the Ruhr 276 tons, and for Upper Silesia 323 tons. The total production of brown coal was 47,912,721 tons, being 1011 tons per miner employed.

The iron-ore production of Prussia in 1906, which amounted to 4,713,928 tons, included: Brown iron ore, 1,451,627; clay ironstone, 37,488; spathic iron ore, 2,277,728; coal measure ironstone, 8699; red hematite, 798,559; magnetite, 32,781; pisolitic iron ore, 96,635; bog iron ore, 5862; clay and brown iron ore, 515, and spherosiderite, 4204.

Mine Valuations

By Algernon Del Mar*

It is safe to say that no two engineers will figure mine valuations on the same basis; nor is it possible to do so, for the actual physical conditions of a mine are variously read by the individual according to his previous experiences or his prejudices. If the problem were one simply of determining the value of the ore blocked out, its profit and the rate of dividends, we might all agree within very narrow limits; but this is not the full problem. The amount of possible ore below the lowest level already developed is often more important than that already blocked out. Here is where the engineer's experience is most needed, for the estimation of the possible amount of ore not visible depends upon physical conditions as interpreted by the particular engineer. He may have geological reasons for his figures; or, perhaps, his basis of calculation may be the results of other experiences in the vicinity, or, again, it may be intuition or something similar, produced by evidences which may be difficult to analyze.

Given the data furnished by the engineer's report, some arbitrary assumptions will be required to facilitate the determination of the advisability of investing in a mine. While I appreciate the fact that investors in mining stocks are, as a rule, looking for a gamble, there may be those who desire to look more closely into the advisability of buying shares for an investment. They would, at least, like to think that they were on the safe side.

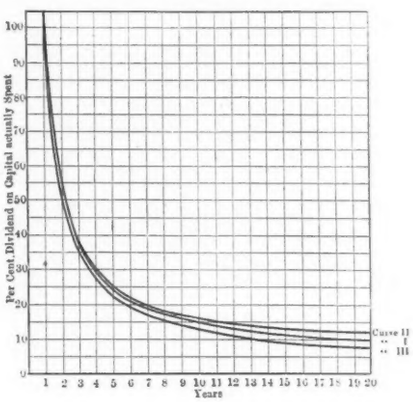
Basis of Calculation

For the purpose of calculation we may assume that all the ore available is that reported by the engineer as blocked out plus that which may be reported as probable ore; so that a vein outcropping on the surface, with no work done, will be considered a speculation in the popular sense of the word, and not an investment. We may also assume that for a mine to be a paying investment it should eventually pay back the original capital invested with interest at a percentage that could be obtained from good securities. This rate of interest must be left to the judgment of the investor according to his ideas of the security market; for the purpose of this argument we will assume that rate to be 5 per cent. per annum. The tonnage of the plant at the mine is an important consideration, for this largely determines the life of the mine, the profits per ton and the necessary dividends that the mine must produce to return the capital and interest. We may assume that at the time when the mine is exhausted the plant will be worthless, which is very near the truth in all cases.

*Mining engineer, New York.

We now see a difference between a mining investment and one in securities; for, while in the former case the principal is lost and must be recovered from the dividends, in the latter the principal is intact at the expiration of the term of years.

There are now three comparisons to be made; the one necessary for the investor to consider will be according to his individual preferences. Curve I, in the accompanying diagram, shows the dividends necessary eventually to realize the same amount as would be obtained if the capital were invested at simple interest. Curve II shows the dividends necessary to realize the same amount as would result if the capital were invested at compound interest, it being assumed that the dividends are not re-invested. Curve III shows the dividends necessary to realize a sum equal to that which might be produced if the capital were invested at compound interest, the dividends being assumed to be re-invested at compound interest.



CURVE SHOWING DIVIDENDS REQUIRED FOR DIFFERENT TERMS OF YEARS

To make the comparison as fair as possible we shall consider only Curve III, which requires the smallest accumulation of dividends. After explaining the formulas employed in plotting the curves, a few examples of their application will be given to make the subject clearer. Let x equal the rate of dividends necessary to return principal and interest in a given time, the residual value of the property being nothing; t, the time in years; r, the rate per cent., and $R, \left(1 + \frac{r}{100}\right)$. The formula for Curve I is then

$$x = r + \frac{1}{t},$$

and that for Curve II,

$$x = \frac{100\,R^t}{t} = \frac{100}{t}\left(1 + \frac{r}{100}\right)^t.$$

This last curve shows that after a certain number of years (20 years, if the interest is 5 per cent. per annum) the rate of interest increases from a minimum; so that to produce the minimum dividends per year to satisfy the comparison the plant should be able to treat enough ore to last this number of years, remembering that the dividends are not reinvested. This is an interesting point.

The formula for calculating the time at which the minimum rate of interest will produce the capital and interest under the conditions of Curve II is as follows, T being the year at which the dividends are at their minimum:

$$T = \frac{0.4343}{log._{10}\left(1 + \frac{r}{100}\right)}.$$

This gives the following minimum rates: 38.2 years at 3 per cent.; 27.1 years at 4 per cent.; 20.7 years at 5 per cent.; 17.3 years at 6 per cent.; 15 years at 7 per cent.; 13.2 years at 8 per cent.; 11.7 years at 9 per cent.; 10.6 years at 10 per cent.

If we assume the dividends to be reinvested as in Curve III, the formula will be

$$x = (R - 1)\frac{R^t}{R^t - 1}.$$

In this case the curve for 5 per cent. interest gradually falls to 5 per cent. and never rises above this amount.

Meaning of the Formulas

The difference between the last two curves and their bearing on mine investments may need further explanation. If the dividends obtained each year from the investment of a certain sum are used by the recipient and not put out at interest, the rate at which the dividends must be paid decreases with the number of years to a minimum and then increases; so that a mine which would stand the test at a certain rate of dividends for a given number of years may not stand the test for a greater number of years beyond the minimum point. In cases where the dividends are re-invested at interest the greater the number of years the mine is paying dividends the less is the rate of dividends necessary.

The following example will show how the calculation is applied: A mine with 17,000 tons of ore blocked out above the 250-ft. level, and 8000 tons of probable ore of the same grade that will net $3.60 per ton with a mill treating 50 tons a day has a total capital invested of $80,000. At 50 tons a day the mine will be exhausted in 1½ years. Referring to Curve III we find that the mine must pay 69 per cent. per year on its capital. A year's work at 50 tons a day will give 17,000 tons at $3.60 profit per ton, or $63,000. This on the investment of $80,000 returns 79 per cent. per annum. Therefore, even if the mine gives out in a year and a half and the plant is then worthless, the enterprise is sound as an investment.

As another example, take the case of a mine showing 2,000,000 tons of ore which will produce $420,000 per annum

when the price of copper is 12c. per lb. and 1000 tons of ore are treated per day. The rate at which the investment is made places the value of the property at $2,500,000. At 1000 tons a day the mine will be exhausted in about six years. Referring to Curve III, we find that the dividends must be at the rate of 19.7 per cent. per year. Dividends of the amount stated will produce 16.8 per cent. per annum; so that this would hardly be an attractive investment. The requirements may be satisfied in three ways: Either the amount of ore must be greater than that stated; the amount treated per year must be greater, or the price of copper must average at least 12½c. per pound.

However much we may desire to consider mining investments from a scientific point of view, there are so many assumptions that enter into the calculation, and ideas of the arithmetical values of the components differ so widely, that no single, definite formula can be used. There are very few commercial ventures which could stand the test applied to the two properties considered above. We must, therefore, come to the conclusion that mining ventures are not more speculative than others in which the factors are uncertain. The honor and ability of those responsible for the venture are the best guarantee that it will turn out profitably.

The Guenther-Francke Process for Nickel-copper Matte

As described in U. S. patent No. 879,633, Feb. 18, 1908, this new process (which is in practical use at Mansfeld, Germany) is adapted to the treatment of nickel-copper matte as follows: Copper-nickel matte is used as anode in an electrolyte containing copper chloride, an alkali chloride, and free hydrochloric acid, whereby copper is deposited at the cathode. Copper chloride is added to the electrolyte during the electrolysis. When the electrolyte is sufficiently enriched in nickel, it is separated from the solid residue of the anode, and subjected to electrolysis, with insoluble anodes, for the purpose of separating the main quantity of the copper. The remainder of the copper is chemically precipitated from the solution, and then the latter is electrolyzed with insoluble anodes to obtain pure metallic nickel. The chlorine produced at the anode is utilized for producing copper chloride from suitable copper ores for use in the first stage of the process.

Inclined shafts are generally cheaper to sink than vertical shafts, but the cost of maintenance is greater because of the greater wear of the track, skip wheels, hoisting rope and the necessity of using wooden rollers, on which the rope can run.

Dycyandiamide in the Determination and Separation of Nickel

By H. Grossmann and Bernhard Schueck*

Nickel frequently occurs in combination with cobalt, zinc, iron and alumina in minerals as well as in finished products. Therefore a rapid and accurate method of separating and determining the nickel is of considerable importance. A new determination recently introduced is based on the fact that nickel is precipitated by dycyandiamidine salts[1] as a compound which is well crystallized and is practically insoluble in ammoniacal water. The reaction is so sensitive that one part of nickel in 200,000 parts of the solution can be detected.

The following is the method adopted for determination: To the solution containing nickel a few drops of chloride of ammonium and an excess of ammonia are added. Then a quantity of the reagent amounting to about four or five times the amount of nickel present is added. On addition of a sufficient amount of potassium hydroxide (10 per cent.) the blue solution turns yellow and the crystalline salt soon begins to precipitate. It is necessary to avoid an excess of ammonium salts, for the nickel dycyandiamidine ($Ni\ (C_2H_5N_4O_6)_2 + 2\ H_2O$) is soluble if large quantities of ammonium salts are present. Also it is advisable to let the cold solution stand over night to insure complete precipitation. The precipitate is filtered through a Gooch crucible, dried at about 115 deg. C. and weighed as $Ni\ (C_2H_5N_4O_6)_2$.

Analyses made by this method agree well with each other and check with analyses made by precipitating the nickel as hydroxide and weighing as nickel oxide. In three analyses the dycyandiamidine method gave 0.1046, 0.1043 and 0.1044 gram, while the hydroxide method yielded 0.1047 gram nickel.

Separation of Nickel from Cobalt, Zinc, Iron and Alumina

The separation of nickel from cobalt is one of the most difficult problems of analytical chemistry. For this separation the new method offers special advantages in regard to speed and convenience. After the addition of a few drops of ammonium chloride, enough ammonia is added to make the solution smell strongly. Then a few cubic centimeters of a 10-per cent. solution of hydrogen peroxide are added. This oxidizes the cobalt to the trivalent form while nickel is not affected. The oxidation may also be effected by a current of oxygen. The solution is then treated as indicated above, the nickel dycyandiamidine filtered off, and the cobalt determined in the filtrate by any of the known methods. Following are the results of a few analyses made according to this method; the cobalt was precipitated as sulphide and determined as sulphate:

	Per cent. Found.	Per cent. Calculated
Nickel	11.68	11.87
Cobalt	9.20	9.16
Nickel	16.01	16.15
Cobalt	4.83	4.77

In the separation of nickel from zinc the procedure is the same as for the separation from cobalt except that the addition of hydrogen peroxide is unnecessary. In order to determine the zinc in the filtrate the solution is concentrated, neutralized with tartaric acid, and an excess of 10 cc. of the saturated solution of tartaric acid added. The addition of a few drops ferric chloride changes the solution to a yellow color. This color disappears when ammonia is poured in slowly. The solution is then ready for titration with ferrocyanide. The accuracy of the method is illustrated by the following analyses:

	Per cent. Found.	Per cent. Calculated.
Nickel	2.17	2.12
Zinc	20.71	20.45
Nickel	15.10	14.97
Zinc	13.94	13.77
Nickel	4.18	4.18
Zinc	20.36	20.32

In the separation of nickel from iron and alumina the iron and alumina are kept in solution during the precipitation of nickel by the addition of an excess of tartrates. In the filtrate iron can be precipitated as hydroxide by boiling; it is filtered off, redissolved and precipitated again with ammonia. In order to determine the alumina remaining in the second filtrate, the tartaric acid present must be destroyed by calcination. The following analyses were made by this method:

	Per cent. Found.	Per cent Calculated.
Nickel	0.1101	0.1123
Iron	0.0614	0.0625
Nickel	0.1110	0.1123
Iron	0.1224	0.1250
Nickel	0.2226	0.2246
Iron	0.1016	0.1000
Nickel	0.1041	0.1043
Aluminum	0.0377	0.0387
Nickel	0.2079	0.2086
Aluminum	0.0376	0.0387

Tantalum is refined (*Min. Journ.*, April 25, 1908) by making it the anode in an electrolytic bath of a fused salt, such as potassium-tantalum fluoride, the cathode being of pure tantalum or other suitable material. The operation may be carried out in a vessel made of magnesium oxide or tantalum oxide. The purified metal can be used for the production of refractory heaters and glowers for electric furnaces and other electric apparatus.

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[1]The sulphate of dycyandiamidine is put on the market by a German firm under the name, "Grossmann's nickel reagent."

Machine Drills for Stoping—II

A Discussion of the Relative Merits of Piston and Air-hammer Drills. Suggested Improvements in Design and Practice. Speed Is Essential

BY EUSTACE M. WESTON*

In attempting in my last paper to forecast the development of rock drilling on the Rand, I anticipated the rise of the hammer drill for short holes. With regard to piston drills, I thought that the practice of using air expansively was scarcely likely to be economical in the long run. Since then, the drill known as the Konomax (Fig. 1), the invention of Mr. Mauss, of the Brakpan Electric Works, has come into prominence. The piston of the Konomax drill consists of two portions A_1 and A_2, working in a corresponding cylinder. The effective area of the face A_3 being double that of the face A_4. The effective area of A_4 is much greater than that of other piston drills of similar diameter, as passages are made past the rifle bar, so that the air pressure acts effectively on the face A_4. This cannot be done with ordinary types, hence this machine has a somewhat more powerful blow for the same piston diameter. The air space of the smaller cylinder, B_1, is in constant communication with the air supply in the hose pipe through the inlet D. The supply of air to the fore part of the large cylinder air space B_2 is taken from B_1, and is controlled by a piston-spool valve P, worked by air pressure to effect the following cycles.

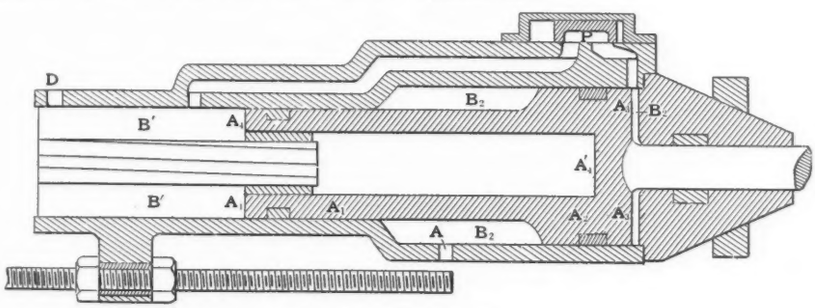

FIG. 1. KONOMAX DRILL

The piston being in the position shown, live air is admitted from B_1 to the front of the piston, and acting on the face A_3 (the area of which is double that of A_4) starts to drive this piston back against the less pressure on the face A_4. At a predetermined point in the back stroke, the valve cuts this supply off, and the air is allowed to expand. This point is generally at half-stroke, giving an expansion of 1:2. As expansion occurs, the pressure on the face A_3 is diminished until it is only equal to that on A_4. This pressure on A_4 is then able to overcome the momentum of the piston and bring it to rest. At this instant the air is exhausted from the front end of the piston by the movement of the valve, and the piston is driven forward, and makes a free stroke. Air is again supplied to A_3, and the cycle repeated.

Atmospheric pressure is maintained between the piston rings by means of an aperture A in the cylinder walls. This is in connection with the arrangement for moving the valve. The machine thus exhausts air once in the cycle, and that upon the backward stroke, instead of twice, as in the ordinary machine. The air is transferred from B_1 to drive the cylinder back.

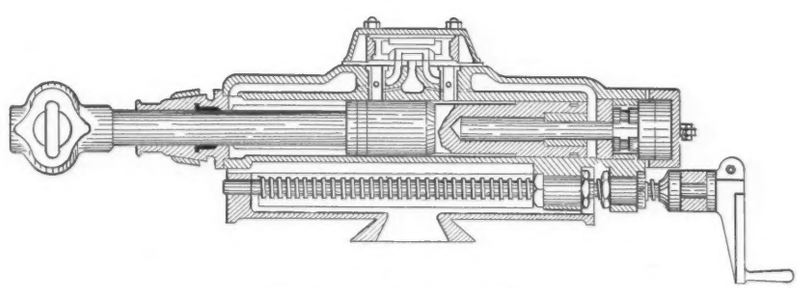

FIG. 2. LITTLE HOLMAN DRILL

The pressure is always maintained behind the rear end. This allows the valve P to be placed right over the front end of the cylinder, thus making the exhaust port short and straight. There is thus no air lost in clearance spaces. The cold, exhausted and expanded air having a direct exhaust, freezing up (which would otherwise occur) is obviated.

Advantages and Disadvantages

With the ordinary 3-in. piston drill, piston area 7 sq.in., assuming a stroke of 6 in., the air consumption on the front stroke amounts to 42 cu.in. But on the back stroke the piston area is diminished by the area of the 1½-in. piston rod and so is only 5¼ sq.in. Therefore the air consumed on the back stroke amounts to 31.5 cu.in. The area of the valve ports and clearance is 18x1x½ in., or 9 cu.in. Therefore the total air consumption of the ordinary piston drill is about 82 cu.in. per double stroke. In the Konomax drill the area of A_3 is 14 sq.in., and the stroke about 6 in. As the cut-off occurs at half-stroke, the air consumption of the Konomax drill is 14x3 or 42 cu.in.

This shows a theoretical saving of about 50 per cent. air, and tests on new machines are said to show this to be obtained. Owing to economy in the valve chest and air-port weights, despite the difference of size of cylinder, the weight of the drill compares favorably with that of those of the ordinary types.

Its detractors and competitors question its power of rapid drilling and state that any theoretical saving of air will be offset in practice by increased leakage. Increased leakage is bound to occur past the piston when worn, as compared with that of an ordinary machine. In an ordinary machine each end is under pressure half its time and the total leakages surface is twice C (where C equals the circumference of a 3-in. circle, or 9.4 in.) for the whole working time. In the Konomax drill B_1 is under pressure for all of the working time, which means 9.4-in. leaking surface, and also the 6-in. diameter piston ring is under pressure half its time = 9.4 in. Therefore the total leaking surface equals 18.8 in., or twice that of an ordinary drill. This may not, however, prove very serious, or very greatly reduce the saving of air.

This system certainly presents great possibilities in air economy, both for piston drills and for hammer drills. However, it has one great defect that must militate against its use in certain work, such as putting down long holes in shafts and winzes. The length of the stroke is

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determined by the gradual equalization of two opposing forces, viz., (1) the air expanding on the front area and (2) the constant pressure on the back. Any addition to the latter force means that the stroke will be shortened, and as the lifting power is diminished, the drill steel will be inclined to stick. This must occur where the weight of long steel is added to the pressure on the back of the piston, and also in flat dry holes where there is great friction on the steel. Hence in such work the ordinary type of machine will more than hold its own.

However, in general free boring, and for stope holes inclined below the horizontal, I think it is proved that the Konomax drills about as rapidly as any drill and at only half the air consumption, costing, say, 3s. to 4s. less per shift for power. Therefore, I think the great field for the machine is at those mines where low air pressure is used. I am disposed to think that the Konomax drill, working at 70 lb. pressure, in most cases could beat any other drill working at 60 lb. pressure. If such a mine should throw out all other machines and install an equal number of this make, it would find the average air pressure improved to such a degree that efficiency in boring would be increased considerably.

I have no interest whatever in this drill, and there still remains the doubt of its efficiency over long periods; but I think, if adopted in this way, it will prove a success, provided that work and material are first class. If, however, it is introduced in twos and threes in large mines, it may fail, for the miners prefer, I think, the old makes. For working with long holes in 40-in. stopes I should certainly like to try a 2⅝-in. Konomax of regular pattern and would expect to save 2s. per shift in air consumption by its use. Mr. Mauss has adapted this principle in an ingenious one-man stope drill of 2-in. piston diameter. This machine is only in its trial stages, but it is certainly the most novel attempt to solve the small stope problem. The valve is placed in the piston itself. The forward feed is by a hydraulic ram, and the waste water from this feed is driven down a hollow piston and hollow steel by a portion of the exhaust, to damp the cuttings in the hole. The rest of the exhaust and water form a spray from the front of the chuck. The machine is said to be incapable of knocking the front head and to work almost automatically. The air consumption is about half that of any other 2-in. machine, and there is, of course, no feed-screw. Doubtless, difficulties will be met with in practice, but the whole idea is ingenious and promising.

Types of Piston Drills

The construction of the Temple-Ingersoll electric air drill has been described many times, therefore a description of it is not necessary. This is now, I believe, about to be introduced on the Rand. It appears to possess many striking features of simplicity and economy, and should be useful for certain work where mines have a supply of current available for underground work. Where drifts can be run with one machine working one shift, and where ventilation is good it should prove economical, as it requires only one-third of the power necessary for a 3¼-in. air drill. Besides, it can easily be taken into very flat stopes and used there.

The Bantam drill has a piston of only 1½ in. diameter. In this drill also the valve is contained in the piston. The air is not worked expansively, and generally the design is the same as that of ordinary types. Its weight is about 56 lb.

The Kid drill, made by the Rand Drill Company, is at work at the Crown Deep mine. It is stated to be stoping ground for 5s. 9.4d. per ton against 6s. per ton by hand labor. The plain slide valve, moved by a tappet, makes the valve action very positive and has several advantages. The wear on the guides is taken up by hammering in the malleable casting; but this does not seem an altogether satisfactory arrangement.

The Holman small drill, Fig. 2, has also a 2-in. cylinder. The designers have used the ball-regulating valves as in the large machines, but have discarded the air-moved valve with the D-slide combined, which I have elsewhere criticized adversely, in favor of a spool-piston valve like that on the Ingersoll machine. The chuck is said to be a much improved one, enabling un-shanked steel to be used, allowing rapid changing and easy re-bushing. The stroke is a long one for this size of drill, being 5 in. The weight of drill is 93 lb. and the length of feed 17 in.

The Little Wonder and Imperial drills, made by Stephens & Co., are air-moved piston-valve drills of the usual type. The chuck used on these machines is claimed to be a great improvement on the ordinary U-bolt chuck in cost of upkeep and rapidity of changing.

The Ingersoll people are not pushing the sale of their 2¼-in. Ingersoll-Sergeant machine, evidently pinning their faith on the Gordon drill.

The Imperial stoping drill is the best out-and-out attempt to construct a one-man machine. It weighs only 75 lb. and has novel features deserving notice. The piston diameter is 1¾ in. and stroke 4 in. An attempt has been made to enable drilling to be performed with equal rapidity in all directions by passing air down hollow steel to the cutting face. The benefit of this in boring up-holes is obvious, as generally the bit has to cut the rock over and over again. Whether there is a perceptible increase in the rate of drilling wet holes is more doubtful. Mr. Stephens, the manufacturer, has had very good results in practice, and has obtained hollow steel that appears to stand the severe work in piston drills. Recently his 2½-in. machine drilled a flat hole in one-third of the time taken by a rival machine of the same diameter using solid steel. Undoubtedly it will do better and quicker all-round drilling work than any others at present at work, and if it will stand up to the work, it will, I think, be a success.

The trouble with the Imperial drill is that a spray must be used with it when uppers are drilled, and miners do not like sprays, as they do not allay all the dust, and the only water often available for them is foul water. Then the cost of upkeep of hollow steel, and of sharpening, is, of course, more than with solid steel, but a very small increase of the rate of drilling will soon pay for that.

I still believe the real need of the Rand is for a small water-feed piston drill, if these small drills are going to hold their own against the water-feed hammer drills. From my remark on hammer drills, it will be evident that I think they are largely the coming solution of the stoping problem, as undoubtedly they should be easier to keep in repair, and cheaper to maintain, than most piston drills. The causes of failure in the past are, I think, largely removable, and, if they are provided with water feed and hollow steel, they should drill almost as rapidly as piston drills with solid steel and are easier one-man machines than most piston drills.

As there would be no trouble with mudding any hole, I should like to try the effect of shortening the stroke to 2 or 2½ in., using a piston of larger diameter. The present long stroke on machines is adapted for low velocities of piston, and to allow of the steel kicking out the mud from the hole, and also to allow of the blunted steel which is often used, as designers know, crushing the rock instead of cutting it. Of course, a drill bit becomes more or less blunted; but by using mostly star bits with a water feed, and working with lengths of steel only a foot in difference, it should be possible to put down a hole 4 ft. deep, all the way with sharp steel.

The long stroke tends to loss of power, owing to vibrations of the machine, which cause the drill bit to strike obliquely on the sides of the hole; this wears the corners off the bits and destroys some of the force of impact on the bottom of the hole. The kinetic energy of the blow depends more on the mass moved than on the velocity, for to double the energy we have to increase the velocity four times. Therefore, I should think that such a drill with a short stroke, provided it were always supplied with sharp steel, should be able to combine some of the advantages of both hammer and piston drills.

By shortening the stroke a valve or valves might be arranged to allow direct exhaust of air at both ends, with very short ports for the entrance of air. With air from 70 to 90 lb. pressure, the number of blows per minute should be well above

900, the rock being then cut by a number of lighter blows. Such a machine would not be of much use with pressures under 60 lb., and no use at all where any drill bits had to be used twice; but with high air pressures (which will surely be arranged for in all new mines by putting up compressors to work at 100 lb. or over, and by scientifically designing the underground pipe lines) it should make an ideal stoping drill, as a simple arrangement could be devised to make it easily controlled by one man. Such a drill would avoid the trouble of needing great care in alinement that hammer drills have, and no bits should stick, even if the water feed were cut off. The stroke being shorter, the edges of the steel would be less worn, and steels could be run on a smaller difference of gage. Working with sharp steel and at a shorter stroke, there would be much less wear and tear; for (apart from carelessness in starting holes) it is pounding blunt steel on the bottom of a hole that knocks piston machines out. This is, of course, only my idea founded on the hypothesis (at present unproved) that a water feed can be successfully used in a piston drill for a long period under working conditions. My reasoning may prove wrong in practice, and such a machine may not drill rapidly.

Problems in Drilling Worthy of Investigation

Really, after all, we know little of the science of rock-cutting and drilling here on the Rand. With all our boasted "brains to the square inch" we have worked disgracefully in the past and wasted power wholesale. Are we going to be content in the future to leave the solving of this problem to manufacturers who themselves, very likely, have no proper data to go on? Thousands of horse-power are used in drilling rock, and yet we are working very much in the dark regarding the true economy of the process. For instance, we know it cannot pay to use a drill bit after it has been blunted to a certain degree; yet thousands are used twice, and we really know nothing of the relative loss in drilling with blunt steel as compared with sharp steel. In mechanical engineering the exact angle of the cutting bit is calculated for different work in different material. Conditions are, of course, different in rock drilling; but no experiments are made to find the best angle for cutting edges of drill bits, and what difference a cutting edge of 90 deg. makes in comparison with one of 60 deg. in hard and soft rock respectively.

Taking into consideration the extra cost of sharpening, providing, and removing extra steel, time lost in changing bits, would it, or would it not pay to run steels in big machines with a difference of 12 or 15 in. instead of 18 or 24 in.? In drilling average "reef," what is the best ratio of foot pounds of energy per inch length of cutting edge for the blow given by a rock drill? What is the best relation between mass and velocity for the striking body? For instance, would not a 2¾-in. machine drilling at 80 lb. pressure drill faster, even with the same size of bit, than a 3¼-in. machine working at 60 pounds?

All these and a host of other questions are, I think, worth answering. Some experts and some manufacturers may know all about them; but I doubt if they do. Surely, it would be worth the industry's while to have a portion of a mine set apart for testing all these questions in our own rock. It would be easy to prepare a large syllabus of experiments worth trying; for instance, to find out what is the exact increase of drilling speed with increased air pressure is worthy of study. The various types and makes of machines could be tested by impartial investigators and their relative advantages and disadvantages become understood.

I have not dwelt much upon relative air consumptions, for it is evident that this is a comparatively unimportant question, because even the saving of 50 per cent. of air in a 3¼-in. drill means only about 3s. or 4s. per shift, and therefore, a drill with double the air consumption is a better drill to use, if it breaks only ½ ton more per shift, or drills from 2 to 3 ft. more. The difference is, of course, less with 2-in. drills.

The same principle applies to cost of maintenance. How much more must a machine that costs £4 per month for maintenance drill than one that costs £2 per month? Obviously, supposing rock broken costs 6s. per ton, and that a 4-ft. hole will break one ton, it has only to bore enough to break seven tons extra per month, or an average of 6 in. per shift to pay for itself. Similarly, to pay for one extra laborer at 3s. per day it must break about ½ ton extra, or drill 2 ft. more per day. Therefore, it will pay better to use a small machine requiring two laborers, using twice as much air, and costing twice as much in maintenance, if it will bore 4 to 5 ft. extra shift. If the cost per ton broken is higher than this, it will need to drill less than this. But in these calculations I have not taken into consideration questions of capital outlay for air compressors in this discussion.

Conclusions

We see, therefore, that our real need is for the quickest drilling tool procurable and the one that will drill the most footage in a given time will justify its existence in the long run. I think that on the Rand the most economical known way of breaking a 36-in. to 42-in. stope is by using 2¾-in. machines drilling 6-ft. holes and working with three machines and seven skilled natives under one white man, where conditions are favorable and air pressure 60 lb. and over; the machines should, if possible, all work on the same face; otherwise two machines per man must be used.

The hammer drill for work in narrow stopes has, I think, come to stay. However, it must have a water feed, causing extra expense for piping and hollow steel against a less cost of upkeep. Whether any type will finally displace the small piston drill boring with solid or hollow steel I do not like to predict.

If hollow steel is coming for piston drills, star bits will have to be made from the solid, and I am certain this always pays in hard ground. Hence drill-sharpening machines that can make machine steel, as well as sharpen it, must come into use more largely.

I am more and more convinced that the question of the air pressure used is a vital one. I am at present employing 90 lb. pressure with 3¼-in. Ingersoll drills in shaft sinking in quartzite, as hard or harder than any reef on the fields. Three 8-ft. holes are easily drilled in two hours. Maintenance costs do not reach £5 per month. This shows that in stoping each machine at present on the Rand should easily drill under such air pressure six or eight holes, 8 ft. long, per shift. One white man per machine might then be employed and costs reduced greatly. The record driving of 225 ft. per month recently done by F. Girdler Brown at the Cinderella Deep was accomplished with air having a pressure of 80 to 90 lb. at the face.

Franklin Mining Company

The annual report of the Franklin Mining Company for the year ended Dec. 31, 1907, shows that this company, produced 4,401,248 lb. of copper, of which 2,020,070 lb. remained unsold at the end of the year. The copper sold in 1907 (2,381,178 lb.) realized $460,465.85, an average of 19.377c. per lb. The working expenses at the mines were $665,938.81; the cost of smelting, freight, marketing copper, etc., was $63,542.58. For construction and equipment at mine and mill, $18,355.81 were spent.

The amount of ore hoisted was 388,165 tons; ore stamped, 383,290 tons; mineral produced, 8,547,696 lb.; mineral in ton of ore stamped, 22.30 lb.; refined copper per tons of ore stamped, 11.48 pounds.

The cost of ore per ton stamped was as follows: Mining, $1.1622; surface, $0.0678; milling, $0.3258; transportation, 0.0948; rock-house expense, $0.0549; general expense, 0.0169; office expense, $0.0127; construction, $0.0478; total, $1.7829. The average number of men employed was 575. The Pewabic lode at the 23d level, the lowest point yet opened, was said to be as good as when first opened.

The emerald mines near Muzo, State of Boyaca, Colombia, are owned by the Colombian Government.

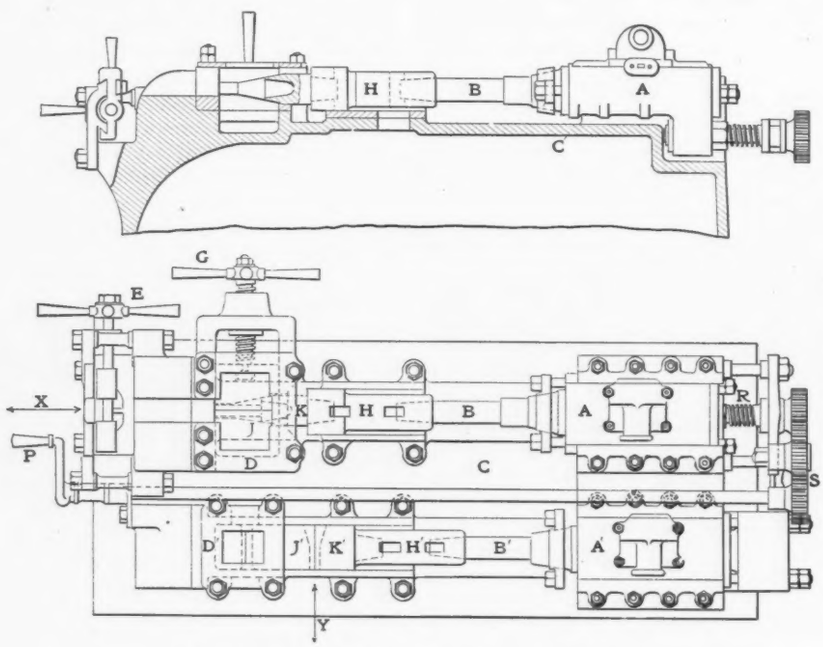
Russia is the chief source of supply of platinum.

Dunstan's Drill Sharpener

SPECIAL CORRESPONDENCE

A new drill sharpener, invented by Nicholas Dunstan, is being placed on the market by the Tuckingmill Foundry Company, of Camborne, Cornwall. The machine consists of two forging hammers mounted horizontally on a bed side by side, with corresponding dies held in boxes on the bed.

The hammers are operated by compressed-air cylinders, shown in the accompanying section and elevation at *A* and *A'*. The piston-rods *B* and *B'* carry tool holders *H* and *H'*, at the end of which are inserted the forging dies *K* and *K'*. The stationary die boxes are shown at *D D'* and the stationary dies at *J* and *J'*. The cylinder *A* is used for upsetting the bar, which is held in line with the piston-rod *B*. Two clamps are used, *E* and *G*, the former to hold the bar in position, and the latter to hold the dies *J* up in close contact with the end of the bar. The position of the cylinder *A* can be varied longitudinally by means of the handle *P* and gear *Q R S*, while the position of the bar between the dies is adjusted by a stop, which is not shown in the illustration.



ELEVATION AND PLAN, DUNSTAN DRILL SHARPENER

The cylinder *A'* is used for cutting out wings and flattening them, the bar being held at right angles to the piston-rod *B'*, as indicated by the arrow *Y*.

When a chisel bit is to be forged out of a new bar, or an old one resharpened, it is first held at *Y* and a few blows given between *J'* and *K'* to flatten it out. It is then inserted in the other side of the machine at *X* and a few blows between *J* and *K* put on a cutting edge.

The forging of a cross-shaped bit takes three operations. The bar is first placed at *X* and the end jumped up, with a slight cross indentation over the top. It is then transferred to the position *Y* and split into wings. By holding the wings to the outer edge of the die they are further flattened out at the edges. The bar is then brought back to the other side of the machine and a few blows of the piston-rod *B* put on a working edge.

If a cross-shaped bit is being resharpened, it is not necessary to insert it in the dies *J K*, so the first operation required in forging a new bar is dispensed with. It is only necessary to cut out the wings and flatten them at *Y* and put on the cutting edge at *X*.

In working the upsetting cylinder it is necessary to hold the bar tightly in two clamps. When working the other cylinder the bar is held in position by the smith, without the aid of clamps. It is understood, of course, that different dies are required for the first operation of upsetting the bar and the final one of putting on a cutting edge when working the cylinder *A*. Also different dies are required when making cross-shaped bits and chisel bits. Different sets of dies are required according to the diameter of the bars treated. In dealing with new bars when making cross-shaped bits, it is desirable to make a large number at once, first giving all the bars the preliminary upset, then changing the dies, and conducting the second and third parts of the operation. The second and third can be done at one heat, as also can be done the two operations in making a chisel bit.

The labor required in working the machine includes a smith and a boy, with one or two boys to bring the bars from the fire. The boy helping to work the machine attends to the admission and cut-off of the compressed air, and tightens up one of the clamps *G*. In no part of the operation is any steel cut to waste. The formation of the cutting edge is done by an upsetting process which obviates loss of steel, and also tends to make the cutting edge stronger.

The makers claim that the machine will forge 50 new chisel bits from the bar in an hour, and sharpen from 100 to 150 old ones. Also that 20 new cross bits can be forged from the bar in an hour, and from 80 to 100 resharpened in the same time.

Determination of Sulphur and Arsenic

W. C. Ebaugh and C. B. Sprague (*Journ.*, Am. Chem. Soc., XXIX, 1475-1476) have described their methods for the determination of sulphur and arsenic with the use of sodium carbonate and zinc oxide. The sulphur method is a modification of the well known Eschka method, while the arsenic method is an improvement over that of Pearce. The sodium carbonate-zinc oxide reagent is made up in the proportion of one part sodium carbonate to four parts zinc oxide and the whole thoroughly mixed.

The sulphur method, usually made on 0.5-gram portions, consists of mixing the weighed amount of the substance to be analyzed, with enough of the sodium carbonate-zinc oxide reagent to furnish at least twice as much sodium carbonate as the sulphur present requires. The mixed portion is placed in a porcelain dish, covered with the reagent, and then heated to redness in a muffle for 15 or 20 minutes. The residue is then extracted with water, boiled, filtered, the filtrate acidified with hydrochloric acid, barium chloride added and the usual procedure followed.

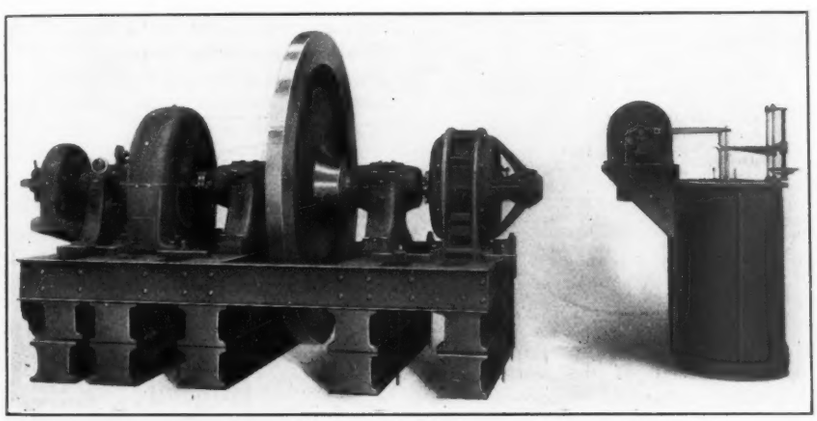
The arsenic method is the same as the sulphur method up to the water extraction of the residue. The alkaline filtrate is acidified with acetic acid, silver nitrate added, the solution boiled and the silver arsenate filtered off. The silver arsenate is thoroughly washed with hot water, dissolved in nitric acid and the silver determined volumetrically with ammonium or potassium sulphocyanate, using ferric sulphate as an indicator.

The method has been successfully used with galenite, pyrite, arsenopyrite, chalcopyrite, sphalerite, etc., with gypsum, anglesite, and also matte, speiss and fluedust. The advantage of this method of decomposition are: That the mass resulting from the heating is not fused and lends itself readily to the water extraction; the ease and speed with which sulphides, sulphates, arsenates, etc., are decomposed; the loss of time in evaporations avoided; and the absence of a large quantity of alkaline and other salts from the solutions in which the precipitations of barium sulphate and silver arsenate are made.

Fly-wheel Motor-generator Set for Operating Electric Hoists

An electric-hoist equipment recently installed by the Kendall Gold Mining Company in a mine of the North Moccasin mountains, Mont., is designed to prevent intermittent load on the hoist from causing fluctuations in the electrical distribution system. The Kendall group of mines is operated by electric power supplied by a hydraulic power house equipped with one pair of 23-in. turbines direct-connected to a General Electric revolving-field 6600-volt, 60-cycle, three-phase alternator of 400 kw. capacity. The power house is situated about two miles from a warm spring having a delivery of 8500 cu.ft. of water at 170 deg. F. all the year round.

The transmission line has a total length of seven miles and operates at the generated voltage of 6600 volts. There is a 100-h. p. General Electric induction motor which drives a No. 5 Gates crusher, three sets of 15x26-in. Gates high-grade rolls, one Jeffery jig screen and two large belt elevators. This plant has a capacity of 500 tons per 24 hours. Besides these, there are installed one 30-h. p., one 15-h. p., three 10-h. p. and four smaller General Electric induction motors driving conveyers, centrifugal pumps, exhaust fans, elevators, and other machinery. A 75-h. p. induction motor is used for driving a seven-drill air compressor.



GENERAL ELECTRIC FLY-WHEEL GENERATOR SET AND AUTOMATIC SLIP REGULATOR

For hoisting the ore from the different levels there is a double drum made by the Denver Engineering Works. The hoisting equipment is designed to raise 2000 lb. of ore from a depth of 1000 ft. every 103 sec. when operating two drums, and every 170 sec. when a single drum only is in operation.

Hoisting Plant

The mine shaft has two compartments, and extends vertically to a depth of 1000 ft. Two cylindrical drums are used, which are provided with the usual clutches for individual and combined running, each drum operating a compartment in which the weight of the rope is balanced by an individual tail rope, whether the other compartment is working or not. This rope is one inch in diameter, and weighs 1.6 lb. per ft. The hoisting speed is 1000 ft. per min. Each compartment is supplied with one skip weighing 1400 lb. and having a capacity of 2000 lb. of ore.

The capacity of the generating station being somewhat limited, the large rush of current incident to starting and accelerating the hoist tends to produce undesirable voltage fluctuation in the system, and the equipment was designed to eliminate this trouble and improve the regulation of the line. To this end an arrangement was supplied which permits of the most perfect speed control, allowing the load to be accelerated as rapidly or as gradually as desired. The equipment was also supplied with a means of equalizing the demand upon the power system, so that instead of being intermittent in character it is practically constant. The system of control has the further advantage of electrically braking the load in a manner which not only gives complete control over the retardation of the moving parts of the hoist, but also returns a considerable portion of the energy to the fly-wheel.

The hoist equipment comprises a shunt-wound direct-current motor, arranged to be geared to the hoisting drums, the motor receiving its power from a motor-generator set driven from the main power system. This set consists of an induction motor and a direct-current generator with a fly-wheel swung between them, and a direct-current exciter overhung at one end. The function of the exciter is to excite the field of the generator and that of the direct-current hoist motor. The direction and speed of rotation of the hoist motor is controlled by reversing and varying the strength of the field of the direct-current generator by means of a rheostat controller, placed near the hoist operator.

In this set the induction motor is a three-phase, 60-cycle, variable-speed machine of the collector-ring type, while the direct-current generator is provided with commutating poles, and is so designed that it will commutate heavy currents with weak fields.

The fly-wheel is a steel casting, machined throughout and perfectly balanced; it weighs about 12,000 lb. and operates at a peripheral speed of about 18,000 ft. per min. The wheel is used to store energy when the hoist is not in operation, and gives up this energy when the demand on the line is at a maximum. To obtain this effect the induction motor is arranged for variable speed operation; changes in speed being automatically controlled by the variation of the main line current, which is led through a small three-phase regulating motor operating a water rheostat in series with the secondary winding of the motor.

The torque which is produced by the full-load value of the main-line current in the windings of the regulating motor is exactly balanced by the weight of the moving parts of the water rheostat, so that there is no change in the resistance that is in series with the rotor winding of the motor-generator set so long as the motor is taking full-load current. If, however, it should demand more or less, there is an immediate change in the resistance of the water rheostat, tending to accelerate or retard the speed of the motor-generator set to such a point that the induction motor once more takes full-load current. The voltage of the exciter is maintained at a constant value during the speed variation of the motor-generator set by means of a Tirrill regulator.

The company's plant has sufficient capacity to furnish the Barnes King Development Company with power for operating a set of motors similar to that used at the Kendall mines, and also power for lighting the town of Kendall.

Consul Isaac A. Manning reports (*Daily Consular and Trade Report,* April 8, 1908), that Colombian capitalists have organized the Cartagena Oil Refining Company, with a capital of $150,000, the object being to exploit a concession for the refining of petroleum in the city of Cartagena. The concession was granted for a period of 20 years, but has already run some four years. The company has begun to erect the necessary buildings and expects to have the machinery all in place and the plant in full operation by July 1. The refinery will have a capacity of about 150,000 cases of refined oil (10 gal. to the case) per annum. The factory will be located on Cartagena bay, near the pier at La Machina. It is the intention of the company to import its crude oil for the present, probably from the United States, but there is an extensive territory along the Caribbean coast of Colombia where petroleum seems to be present, and later the company expects to attempt the development of these deposits.

India's Mineral Production

Consul E. Haldeman Dennison, of Bombay, furnishes the accompanying table published by the government of India, giving the total value of minerals for which returns of production are available for the years 1905 and 1906, with a review of mining operations.

	1905.	1906.
Gold	$12,084,855	$11,151,420
Coal	7,697,215	9,560,210
Petroleum	3,021,315	2,871,190
Salt	2,206,960	2,104,505
Saltpeter	1,178,615	1,352,735
Manganese ore	1,241,545	2,176,340
Mica	710,040	1,297,720
Ruby, sapphire and spinel	441,700	484,335
Jadestone	227,370	322,165
Graphite	84,450	50,045
Iron ore	69,135	56,705
Tin ore	49,585	68,995
Chromite	17,410	35,940
Diamonds	12,370	25,800
Magnesite	2,750	2,440
Amber	4,725	3,545

Coal—The output of coal increased from 8,417,739 statute tons in 1905 to 9,783,250 tons in 1906. On account of the higher prices maintained throughout the year, there was a still greater proportionate increase in reported spot value. The external demand for Indian coal has increased with the general rise in prices, and the reduction of Japanese supplies has resulted in an increased export to Singapore. The total quantity exported during 1906 for the first time in 12 months exceeded 1,000,000 tons. Imports of coal are still small, though they increased from 188,677 tons in 1905 to 215,712 tons in 1906. The consumption of Indian coals on railways was 2,878,281 tons in 1906, which was 29.4 per cent. of the total production, as against an average of 29.8 per cent. for the previous five years. The total consumption of coal increased by 1,161,850 tons but, on account of the great increase in export, the amount of Indian coal consumed in the country increased at a slightly lower rate than the production. The average number of workers at Indian coal mines in 1906 was 99,138, and the average output per person employed was 98.68 tons, as against 93.5 tons in 1905 and 88.6 tons in 1904.

Diamonds, Gold, Jadeite and Graphite—The diamonds obtained in the central India States of Panna, Charkhari and Ajaigarb during 1906 were valued at $25,800, which is a marked improvement on the values reported for previous years. The average daily number of workers was reported as 2051 for the whole diamond field during 1906, as against 1890 reported for 1905. Over 95 per cent. of the gold produced in India comes from the native State of Mysore; other districts contributing small quantities, in the order named, are Hyderabad, Burma, Dharwan in the Bombay Presidency, Punjab and the United Provinces. The year 1906 marks the first interruption in the increase of gold production in Mysore. The total production of crude graphite in 1906 was returned as 2600 tons, valued at $50,045, against 2324 tons, valued at $84,450 in 1905. Jadeite stone comes from Upper Burma, and showed a small increase in both quantity and value over 1905. The returns for 1906 showed a production of 2566 cwt., valued at $322,165. The average number of workmen employed was 1038.

Magnesite, Manganese and Iron Ores, and Mica—The amount of magnesite raised in the Chalk hills, near Salem, in 1906 was 1832 tons, against 2063 tons in 1905. The miners numbered 87 in 1906. The production of iron ore during 1906 was only 74,106 tons, against 102,579 tons in 1905. The output is dominated by the quantity raised for the Barakar iron works, which is the only institution smelting on European lines. Practically all the iron ore of India is supplied by the province of Bengal.

The most conspicuous increase in production during the year 1906 was in manganese ore. The total reported was 495,730 tons, against 253,896 tons in 1905 and only 150,297 tons in 1904. The total reported for 1906 is probably slightly below the actual, as no production was reported from two of the States in which prospecting operations have been carried on actively. The following are the details of the production of manganese ore for 1905 and 1906:

District.	1905. Statute Tons.	1906. Statute Tons.
Bombay	.....	7,517
Central India	30,251	50,074
Central provinces	159,950	320,759
Madras	63,695	117,380
Total	253,896	495,730

The labor returns for 1905 show a daily average at manganese ore quarries of 6811, while in 1906 the total rose to 12,607, exclusive of the workmen employed in Sundur and Mysore.

The total weight of mica produced in 1906 was 54,193 cwt., valued at $1,297,720, against 25,835 cwt., valued at $710,040, in 1905.

Petroleum—There was a slight drop in the production of petroleum for 1906 as compared with 1905, the statistics being as follows:

District.	1905. Gal.	1906. Gal.
Burma	142,063,846	137,654,261
Eastern Bengal and Assam	2,733,110	2,897,990
Punjab	1,488	871
Total	144,798,444	140,553,122

The local value is estimated at about 2c. per gal. of crude oil. The agreement made between the leading company in Burma and the producers in the Dutch East Indies has tended to reduce the figures both for the import of foreign kerosene and for the export of Burma oil, although the figures for the former are largely affected by the failure of Russian supplies.

Rubies, Sapphires, Spinel, Salt, Saltpeter and Tin—The output of ruby, sapphire and spinel, reported by the Burma Ruby Mines Company during the year ended Feb. 28, 1907, was 326,855 carats, valued at $477,700, against a value of $441,700 returned for the previous year. Of the total value, $465,115 is credited to the rubies obtained. The average number of workers during 1906 was 2367. There was an unimportant reduction in the quantity of salt produced, the total for 1906 being 1,225,465, against 1,291,137 tons produced in 1905. The value of the saltpeter production is gaged most uniformly by the figures for exports. The returns for the past five years indicate a gradual rise in the average value, but the industry shows no signs of real expansion. The following are the export figures:

	Cwt.	Value.
1905	313,122	$1,178,615
1906	347,251	1,352,735

The local importance of the saltpeter industry is shown by the returns for labor in Behar, where most of the saltpeter is obtained. The returns for 1906 show that 50,469 workers were employed in this industry. Tin ore is produced in South Burma, and the output increased from 1495 cwt., valued at $49,585 in 1905, to 1919 cwt., valued at $68,995 in 1906. The average number employed at the tin mines was 141 in 1906.

British Steel Production

The British Iron Trade Association reports the production of open-hearth steel in Great Britain for the year as follows, in long tons:

	1906. Tons.	1906. Per Ct.	1907. Tons.	1907. Per Ct.
Acid	3,378,691	74.2	3,384,780	72.6
Basic	1,176,245	25.8	1,278,709	27.4
Total	4,554,936	100.0	4,663,489	100.0

The increase in acid steel was 6089 tons, and in basic 102,464; the total gain being 108,553 tons, or 2.4 per cent. The increase was chiefly in basic steel.

The total number of open-hearth furnaces in Great Britain is 499, of which 107 were idle last year and 399 in operation, 305 being acid and 87 basic furnaces. The average output per furnace was 11,098 tons for the acid and 14,698 tons for the basic furnaces. At the close of the year, 14 new furnaces were under construction, 10 being for the acid and four for the basic process.

A partial report of the forms in which open-hearth steel was sold in 1907 is as follows: Blooms and billets, 580,961 tons; bars and tinplate bars, 950,938; plates and angles, 1,769,855; structural shapes, 266,821; rails, 79,532 tons. All these show increases over 1906, except rails, in which there was a small decrease.

American capitalists are interesting themselves to a great extent in the platinum industry of Russia.

Conservation of Ores and Minerals

Wasteful Use of the Country's Supply of Coal, Iron Ore and Other Minerals and Methods of Delaying Their Exhaustion

BY ANDREW CARNEGIE

When the republic was founded there were, according to recent expert estimates, approximately 2,000,000,000,000 tons of coal in the territory now forming the United States. Practically none of this supply was used for over a quarter century; but during the 75 years from 1820 to 1895 nearly 4,000,000,000 tons were mined by methods so wasteful that some 6,000,000,000 tons were either destroyed or allowed to remain in the ground, forever inaccessible. During the 10 years from 1896 to 1906 as much was produced as during the preceding 75 years; while more than 3,000,000,000 tons were destroyed or left in the ground, beyond reach of future use. To date, the actual consumption of coal has been over 7,500,000,000 tons; the waste and destruction in the neighborhood of 9,000,000,000 tons. If mining were perfected from now forward, we might reckon that considerably less than 1 per cent. of our original stock has been consumed; but, estimating on the basis of the wasteful methods hitherto pursued, nearly 2 per cent. of our available supply is gone.

Coal consumption is increasing at an astonishing rate. During the period for which statistics have been gathered, it has doubled during each decade; of late it has more than doubled. In 1907 the production was about 450,000,000 tons. At the present rate of increase, the production of 1917 will be 900,000,000 tons; in 1927, 1,800,000,000 tons, and in 1937 over 3,500,000,000 tons, or an amount in that year alone nearly equal to the production of the 75 years ending in 1895; and, with continuation of the wasteful methods of mining, the consumption and destruction together during that one year would equal our total useful production up to the present date. And at that time—which many of us will live to see—more than an eighth of our estimated original supply will have been consumed or destroyed.

Outlook for Next Century

All estimates of future consumption and destruction of coal are liable to error; yet, making all reasonable allowance, unless there be careful husbanding, or revolutionizing inventions, or some industrial revolution comes which cannot now be foreseen, the greater part of that estimated 2,500,000,000,000 tons of coal forming our original heritage will be gone before the end of the next century, say, 200 years hence.

To each generation the ultimate disappearance of coal is of less concern than current prices. With the working out of seams and fields, plants and transportation facilities are removed or abandoned, and other losses are incurred; and the cost of these in the end increases prices. Already this is felt; it is estimated that by reason of the progressive exhaustion of American fields, coal consumers are today paying on an average 10 per cent. or 15 per cent. more than would be necessary if the supply were unlimited—and the advance must continue with each decade as the supply lessens.

Still more wasteful than our processes of mining are our methods of consuming coal. Of all the coal burned in the power plants of the country, not more than from 5 to 10 per cent. of the potential energy is actually used; the remaining 90 per cent. to 95 per cent. is absorbed in rendering the smaller fraction available in actual work. In direct heating the loss is less, but in electric heating and lighting it is much more—indeed, in ordinary electric-light plants hardly one-fifth of 1 per cent., one five-hundredth part, of the energy of the coal is actually utilized. There is at present no known remedy for this. These wastes are not increasing; fortunately, through the development of gas producers, internal-combustion engines, and steam turbines they are constantly decreasing; yet not so rapidly as to affect seriously the estimates of increase in coal consumption. We are not without hope, however, of discoveries that may yet enable man to convert potential into mechanical energy direct, avoiding this fearful waste. If that day ever come, our coal supply might be considered unending.

The same spirit of recklessness that leads to waste in mining and in the consumption of coal leads to unnecessary risk of human life. During the year 1907 in the United States the killed and wounded in coal-mining operations exceeded 9,000. The danger to life and limb in the mines is increasing far more rapidly than production, because gas becomes more abundant and the work of rescue more difficult as the mines extend deeper or farther from the entrance.

Iron

When the republic was started in 1776 little iron was used. Each family was content with a few score pounds in the form of implements, utensils, and weapons, so that the average annual consumption was but a few pounds per capita. In 1907 alone the production of iron ore in the United States was 53,000,000 tons, or more than 1200 pounds for each man, woman and child of our 88,000,000 population. And the production is steadily increasing.

The latest trustworthy estimates of our present stock of iron ore are: For the Lake Superior district, about 1,500,000,000 tons; for the Southern district (including Alabama, Georgia, Tennessee, and Virginia), about 2,500,000,000 tons; and for the rest of the United States, 5,000,000,000 to 7,000,000,000 tons—making an aggregate of about 10,000,000,000 tons.

The total production of iron ore in the United States up to 1890 was some 275,000,000 tons; in the next 10 years it was nearly 200,000,000; and in the seven years from 1901 to 1907 more than 270,000,000 tons were produced, or nearly as much as the total for the first century of our history. The aggregate production to date, 750,000,000 tons, is about one-thirteenth of the estimated original supply. At the recent rate of increase (doubling each decade) the production in 1918 will exceed 100,000,000 tons; by 1928, 200,000,000 tons, and by 1938 it will be over 400,000,000 tons—i.e., in that single year, which many of us may expect to see, an amount approximating the entire production in the United States up to the close of last year. By that date about half of the original supply will be gone, and only the lower grades of ore will remain; and all the ore now deemed workable will be used long before the end of the present century.

Copper, Lead and Zinc

Next to iron our most useful metal is copper. It was the only metal used effectively by the natives of North America before Columbus landed; and for over three centuries native copper was mined and wrought by white men chiefly in Indian mines and by Indian methods. The mining and reduction of copper ores has grown up within 50 years; and within a dozen years the copper industry has been revolutionized through electrical application. Although production is enormous and increasing apace, it fails to keep up with the demand, which more than in any other commodity is limited by price. If the current price could be reduced 35 per cent. the demand would be doubled or tripled; if it could be reduced 50 per cent. copper would replace iron for roofing, cornices, piping, and other constructional

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Note—This is the principal part of the address of Andrew Carnegie, on "Conservation of Ores and Minerals," read May 13 before the White House conference on national resources.

purposes so as to raise the demand tenfold if not more. While the stock of copper in the ground has not been estimated (miners and operators deeming the supply unlimited, just as a generation ago they thought iron inexhaustible), unless the quantity exceeds the indications, it clearly cannot long withstand the demands which would follow any great reduction in price. Unless it does so, the use of copper cannot seriously check the drain upon our iron resourses.

Zinc, lead, silver, and other ores abound in our rocks, and their production is steadily increasing. Neither the original supplies nor the time they will last have been estimated; it is known only that one mine or district after another has been worked out, or the depths of the workings so increased as to raise the cost to a prohibitive figure and compel abandonment. The current and avoidable waste in mining and reducing these and the copper ores is estimated by experts to average 30 per cent.

Gold

As iron and coal are the basis of industrial values, so gold is the basis of commercial values. Though there is enough gold-bearing mineral in the United States to give this country powerful influence in maintaining parity of gold, the aggregated supply has not been estimated—indeed it cannot be, since nearly all rocks and earths and even the waters contain gold in various quantities, so that production is controlled wholly by the market price. Our production is large and steadily increasing; though the increase does not quite keep pace with that of such staples as corn, cotton, wheat, sugar, iron, coal, copper, silver, lead, and zinc. Doubtless the duration of the supply will depend solely upon commercial conditions. The waste in mining and reduction has always been large, ranging from 25 per cent. to 50 per cent.—indeed it is not uncommon for later miners to get their best returns from working the tailings left by their predecessors.

In view of the sobering facts presented, the thoughtful man is forced to realize, first, that our production and consumption of minerals are increasing much more rapidly than our population; and second, that our methods are so faulty and extravagant that the average waste is very great, and in coal almost as great as the amount consumed. The serious loss of life in the mines is a feature that can no longer be overlooked. Nor can we fail to realize that the most useful minerals will shortly become scarce and may soon reach prohibitive cost unless steps to lessen waste are taken in the interest of the future.

I have for many years been impressed with the steady depletion of our iron ore supply. It is staggering to learn that our once supposed ample supply of rich ores can hardly outlast the generation now appearing, leaving only the leaner ores for the later years of the century. It is my judgment, as a practical man accustomed to dealing with those material factors on which our national prosperity is based, that it is time to take thought for the morrow. I fully concur in the opinion of the President that the state of our resources raises one of the most serious issues now before the American people, and hope that this national meeting will lead to wise action.

Saving Waste

Let us begin with iron: We must in all possible ways lessen the demands upon it, for it is with iron ore we are least adequately provided. One of the chief uses of this metal is connected with transportation, mainly by rail. Moving 1000 tons of heavy freight by rail requires an 80-ton locomotive and twenty-five 20-ton steel cars (each of 40-ton capacity), or 580 tons of iron and steel, with an average of, say, ten miles of double track (with 90-pound rails), or 317 tons additional; so that, including switches, frogs, fish-plates, spikes, and other incidentals, the carriage requires the use of an equal weight of metal. The same freight may be moved by water by means of 100 to 250 tons of metal, so that the substitution of water-carriage for rail-carriage would reduce the consumption of iron by three-fourths to seven-eighths in this department. At the same time the consumption of coal for motive power would be reduced 50 to 75 per cent., with a corresponding reduction in the coal required for smelting. No single step open to us today would do more to check the drain on iron and coal than the substitution of water-carriage for rail-carriage wherever practicable, and the careful adjustment of the one to the other throughout the country.

The next great use of iron is in construction, especially of buildings and bridges. Fortunately, the use of concrete, simple and reinforced, is already reducing the consumption of structural steel. The materials for cement and concrete abound in every part of the country; and while the arts of making and using them are still in their infancy, the products promise to become superior to steel and stone in strength, durability, convenience, and economy of use. The cement industry is growing rapidly, largely in connection with the making of iron and steel, so that the substitution of the new material will not involve abandonment of plants or loss of invested capital.

A large current use of steel of the highest quality is for battleships, ordnance, projectiles, and small arms. Happily, there are signs of an awakening of the public conscience and of the sense of national righteousness, whereby civilized nations must be led to adopt those moral standards which already regulate individual conduct; the world is soon to learn that war is not only too disgracefully inhuman, but too wasteful, to be tolerated, and this serious drain upon our iron ores will cease. * * *

Among the most abundant materials of the earth-crust are silica, alumina, and carbon compounds, all with more or less affinity for iron; already the alloying of carbon with iron has revolutionized the industrial world, and of late the alloying of silica with iron (in "ferro-silicon," etc.) gives promise not only of yielding a superior metal, but of permitting reduction of silicious ores hitherto unworkable, while aluminum has been alloyed with iron in a useful way. It is not too much to hope that research into the ultimate constitution and relation of these commoner materials will yield both better and cheaper metals than any thus far produced, and that newly discovered alloys will help to relieve the pressure on our mines of iron, copper, zinc, silver, and lead.

Saving in Use of Coal

We now come to coal. How shall we save that? Current uses—or rather current wastes—offer suggestions: The most serious waste arises from imperfect combustion in furnace and firebox. The waste of 90 per cent., and over of the potential energy of the fuel in power-production—which, however, we know not yet how to avoid—is appalling in itself, while the smoke and soot from the chimneys becloud and befoul cities, poison human lungs, and prepare the way for pneumonia (one of our worst modern scourges), and initiate all manner of additional wastes. We have already learned that internal-combustion engines and gas-producers double or triple the power per unit of coal, obviate the smoke nuisance and also permit the use of lignite, culm, slack, and inferior coals—in fact, so far as power-production by reciprocal engines is concerned, the days of steam seem to be numbered, although the development of substitutes is still in its infancy. The consumption of coal in smelting is necessarily large; of late the loss is reduced by using the furnace gases for power, and by making by-products; yet the chief saving must lie in economy in the use of metals. Much of our coke-making is still extravagant; some ovens use the gases, and all should do so without delay—if necessary, under State regulation, since the people have some rights both in the preservation of their heritage and in maintaining the purity of the air they breathe.

Next to imperfect combustion, the chief waste of coal arises in mining. Now that the coal in the ground is recognized as part, and a great part, of the value of coal lands, self-interest impels the operator to take out all he can, and leads the miner to work close to floor and roof. Bad results may sometimes follow, as in the anthracite region, where the entire forest growth has been stripped and both land and streams ruined to timber the

mines, and in those terrible accidents when in removing the pillars of coal the miners are buried. Coal mining cries out for expert knowledge whereby the full yield may be obtained without needless risk or loss; and for wise police regulation whereby life may be protected against ignorance and cupidity.

The most promising check on coal consumption is the substitution of other power. Naturalists tell us that coal is a reservoir of solar energy stored up in ages past, and that the same is partly true also of other chemically complex substances, including ores. The sun-motor still runs; its rays render the globe habitable, and may yet be made to produce power through solar engines, or may be concentrated in furnaces—as in the Portugese priest's heliophore at the St. Louis Exposition, with its temperature of 6000 degrees Fahrenheit, in which a cube of iron evaporated like a snowball in a bessemer converter. The sun helps to raise the tides, which some day will be harnessed. * * * It is only within the past decade that electrical transmission has made water-power generally available for driving machinery, for smelting, and for moving trains, and has at the same time created a new market for copper; yet it is a safe forecast that this method of using solar energy (for water power is the product of sun-heat) will soon affect the constantly increasing drain on our coal. And just as the woods and the ores and the mineral fuels have become sources of wealth and power within our memory, so will become the running water within a few years!

Research Required

No practical man can study our mineral supplies without seeing that they are melting away under our national growth at a geometrically increasing rate, and without realizing that unless the loss is checked his descendants must suffer; nor can he consider ways of preserving the supply without realizing the need of wider and deeper knowledge than we now possess. It was not resources alone that gave this country its prosperity, but inventive skill and industrial enterprise applied to its resources. Individually we have been both forehanded and foreminded; nationally we have been forehanded chiefly through the accident of discovery of John Smith and Walter Raleigh, but nationally we are not yet foreminded. So far as our mineral wealth is concerned, the need of the day is prudent foresight, coupled with ceaseless research in order that new minerals may be discovered, new alloys produced, new compounds of common substances made available, new power-producing devices developed. The most careful inventory of the family patrimony should be made. I plead for economy, that the next generation and the next may be saved from want—but especially I urge research into and mastery over nature.

The Lane Mill

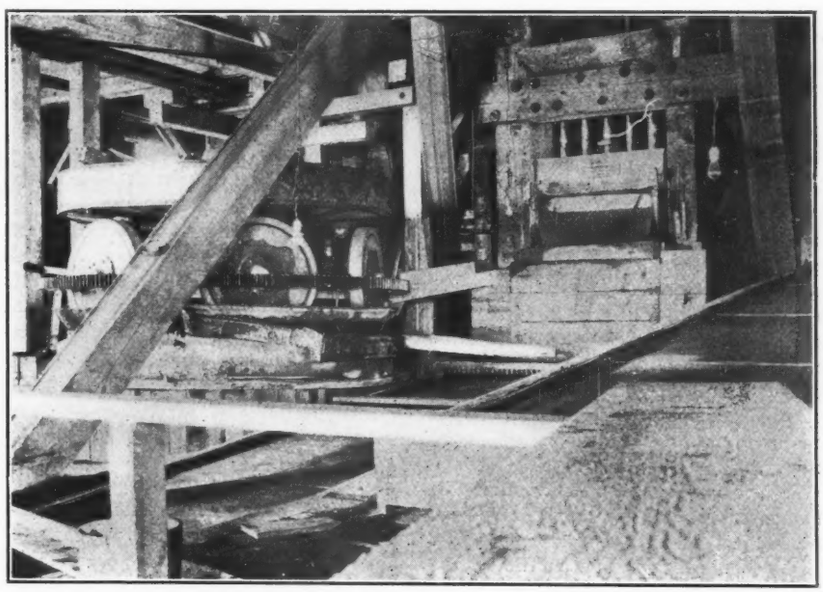
This mill, which is a slow-speed edge runner, is employed for regrinding and amalgamating ore crushed by rolls or stamps. At the Bonita 10-stamp mill, at Barron, Wash., a 10-ft. Lane mill has been installed to grind the pulp from one of the 5-stamp batteries. A side-by-side test comparing the new installation with the old system of doing all the fine crushing in the battery showed the relative efficiencies of the two systems.

A 4-mesh No. 16 wire screen was used on the battery, crushing for the Lane mill, and on the Lane mill an 8-mesh wire screen. Both batteries of stamps had a 6-in. drop, and the hight of discharge was 4½ in.; in the Lane mill the hight of discharge was 6 in. The pulp from the Lane mill was discharged upon plates of 91 per cent. The screen analyses of the tailing and the concentrate were also favorable to the Lane system, as the accompanying table shows.

SCREEN TESTS OF TAILINGS AND CONCENTRATE AT BONITA MILL.

Mesh,	Stamp System.		Lane System.	
	Tailing. Per Cent	Concentrate. Per Cent.	Tailing. Per Cent.	Concentrate. Per Cent.
On 30	10	4	4	1
30 - 40	20	8	8	3
40 - 60	28	22	22	4
60 - 80	6	10	10	4
80 - 100	22	20	20	8
Through 100 ..	14	36	36	80

The cost of installing the Lane mill did not exceed $3500, although the freight



LANE SLOW-SPEED MILL AT THE BONITA MILL

5 ft. wide and 18 ft. long, whence it flowed to two Wilfley tables. On the other battery a 25-mesh screen was used. The pulp from the stamps went to plates and Wilfley tables.

With the stamps dropping 96 times per minute and the Lane mill making 6 revolutions per minute, the Lane-mill system crushed 40 tons per 24 hours, while the stamp system crushed 16 tons per 24 hours through the 25-mesh screen. The power required to run the Lane mill at full load was 12 h.p. The average of hourly samples, taken over a period of three days from the batteries, at the foot of the plates, and from the concentrators, showed that the stamp system saved 51 per cent. on the plates, while the samples from the Wilfley tables showed a saving of 80 per cent. With the Lane system the tailing from the plates showed a saving of 65 per cent., and the sample from the Wilfley tables showed an extraction

cost 3½c. per lb. from Seattle. To have installed stamps to crush the increase in tonnage would have cost about $12,000. It would have been necessary to build additional ore bins, to enlarge the building, and to add more plates and feeders. The results obtained with the new mill were so gratifying that four more of the same type will be installed.

In lower California, David Goldbaum has been using a 7-ft. Lane mill for several years. With this mill he has crushed from 600 to 800 lb. of ore per hour, the amount varying according to the size of the crushed ore fed to the mill. In one case he crushed per hour 1000 lb. of ore, broken to ¼-in. size. He uses a 12-h.p. boiler and a 10-h.p. engine to run a rock breaker, a Lane mill and pumps. The Lluvia De Oro Gold Mining Company at Lluvia de Oro, Chihuahua, is installing three mills of the same kind in its new 100-ton mill.

Conservation of Natural Resources

The following is the declaration that was unanimously adopted at the conference of the Governors at the closing session at the White House, May 15, 1908:

We, the Governors of the States and Territories of the United States of America, in conference assembled, do hereby declare the conviction that the great prosperity of our country rests upon the abundant resources of the land chosen by our forefathers for their homes and where they laid the foundation of this great nation.

We look upon these resources as a heritage to be made use of in establishing and promoting the comfort, prosperity and happiness of the American people, but not to be wasted, deteriorated or needlessly destroyed.

We agree that our country's future is involved in this; that the great national resources supply the material basis upon which our civilization must continue to depend and upon which the perpetuity of the nation itself rests.

We agree, in the light of facts brought to our knowledge and from information received from sources which we cannot doubt, that this material basis is threatened with exhaustion. Even as each succeeding generation from the birth of the nation has performed its part in promoting the progress and development of the republic, so do we in this generation recognize it as a high duty to perform our part, and this duty in large degree lies in the adoption of measures for the conservation of the natural wealth of the country.

We declare our firm conviction that this conservation of our natural resources is a subject of transcendent importance which should engage unremittingly the attention of the nation, the States and the people in earnest coöperation. These natural resources include the land on which we live and which yields our food; the waters, which fertilize the soil, supply power and form great avenues of commerce; the forests, which yield the materials for our homes, prevent erosion of the soil and conserve the navigation and other uses of our streams, and the minerals, which form the basis of our industrial life and supply us with heat, light and power.

We agree that the land should be so used that erosion and soil wash should cease, that there should be reclamation of arid and semi-arid regions by means of irrigation and of swamp and overflowed regions by means of drainage; that the waters should be so conserved and used as to promote navigation, to enable the arid regions to be reclaimed by irrigation, and to develop power in the interests of the people; that the forests, which regulate our rivers, support our industries and promote the fertility and productiveness of the soil, should be preserved and perpetuated; that the minerals, found so abundantly beneath the surface, should be so used as to prolong their utility; that the beauty, healthfulness and habitability of our country should be preserved and increased; that the sources of national wealth exist for the benefit of all the people and that the monopoly thereof should not be tolerated.

We commend the wise forethought of the President in sounding the note of warning as to the waste and exhaustion of the natural resources of the country and signify our high appreciation of his action in calling this conference to consider the same and to seek remedies therefor through a coöperation of the nation and the States.

We agree that this coöperation should find expression in suitable action by the Congress within the limits of and coextensive with the national jurisdiction of the subject and, complementary thereto, by the Legislatures of the several States within the limits of and coextensive with their jurisdiction.

We declare the conviction that in the use of the natural resources our independent States are interdependent and bound together by ties of mutual benefits, responsibilities and duties.

We agree in the wisdom of future conferences between the President, members of Congress and the Governors of the States on the conservation of our natural resources with the view of continued coöperation and action on the lines suggested. And to this end we advise that from time to time, as in his judgment may seem wise, the President call the Governors of the States, members of Congress and others into conference.

We agree that further action is advisable to ascertain the present condition of our natural resources and to promote the conservation of the same. And to that end we recommend the appointment by each State of a commission on the conservation of natural resources to coöperate with each other and with any similar commission on behalf of the Federal Government.

We urge the continuation and extension of forest policies adapted to secure the husbanding and renewal of our diminishing timber supply, prevention of soil invasion, the protection of headwaters and the maintenance of the purity and navigability of our streams. We recognize that the private ownership of forest lands entails responsibilities in the interests of all the people, and we favor the enactment of laws looking to the protection and replacement of privately owned forests.

We recognize in our waters a most valuable asset of the people of the United States and we recommend the enactment of laws looking to the conservation of water resources for irrigation, water supply, power and navigation, to the end that navigable and source streams may be brought under complete control and fully utilized for every purpose. We especially urge on the Federal Congress the immediate adoption of a wise, active and thorough waterway policy, providing for the prompt improvement of our streams and conservation of their watersheds required for the uses of commerce and the protection of the interests of our people.

We recommend the enactment of laws looking to the prevention of waste in the mining and extraction of coal, oil, gas and other minerals, with a view to their wise conservation for the use of the people and to the protection of human life in the mines.

Let us conserve the foundations of our prosperity.

North Star Mines Company

During the calendar year 1907 the North Star Mines Company produced 78,366 tons of ore yielding $937,817 or $11.967 per ton. Operating and development expenses were $491,956 leaving an available profit of $445,861. Improvements and property purchase reduced this balance to $403,321. interest earnings increased it to $426,081 and dividends of $250,000 brought the year's surplus to $176,081 which was added to the previous surplus making the cash balance, at the close of the year, $362,696. Investments, bills receivable and materials and supplies brought the total balance to $771,086.

The ore produced was less than in 1906 by about 6300 tons on account of labor troubles which closed down the workings during January and February, 1907. However, the increased value of the ore compensated for the decreased tonnage and the gross value exceeded that of any previous year.

Of the total product, 21,211 tons came from the old workings on and above the 2700-ft. level; the ore yielded $296,799 or $13.993 per ton and with operating costs of $6.084 per ton gave a net profit of $7.909 per ton. Development and exploration in the old workings brought the total cost to $7.768 per ton of ore produced. From the deep workings (below the 2700-ft. level) 57,155 tons were extracted which yielded $641,018 or $11.215 per ton. At a cost $4.722 for operation and $1.002 for development and exploration, the net profit was $5.491 per ton.

Good ore was opened, in the old workings, by persistent drifting and in the deep levels the stopes have continued steadily to yield a full supply of somewhat better ore than in previous years. The bulk of the ore now comes from below the 2700-ft. level. On the 4400- and 4700-ft. levels drifts have been extended in both directions and the sinking of the inclined shaft on the vein, from the bottom of the Central vertical shaft at the 4000-ft. level was continued. At the close of the year this shaft was 5000 ft. deep on the dip or 2000 ft. vertically below the surface.

The Coal Industry of Montana

About $6,000,000 Is Invested in Coal Properties. Twenty-four of the Twenty-seven Counties Are Underlaid with Either Coal or Lignite

BY JESSE P. ROWE*

Not until recent times have the coal mines of Montana been much discussed. However, within the past five years, the State and the United States Geological Surveys have paid more attention to this branch of economic geology. Many calorific tests and chemical analyses, both proximate and ultimate, have been made since that time. Several carloads of coal for testing purposes have been shipped to the U. S. Geological Survey, in St. Louis and in Denver. With the price of coal mined in Montana and northern Wyoming and southern Canada, ranging from $8.50 to $10.00 per ton, it is surely time to investigate the State's natural fuel resources.

Coal has been mined in Montana since 1880. However, during that year, but 224 short tons were produced, valued at about $800. The methods in the early days were most simple and the distance to market was almost prohibitive of a large trade. Little over a quarter of a century has made many changes, both in the production and the methods of handling.

Five years after coal was first produced in the State, about 190,000 tons were mined. In 1890 over 500,000 short tons of native coal and lignite were placed upon the market; this was valued at about $1,250,000. From 1890 to 1895, the production increased from 500,000 tons to more than 1,500,000 tons in 1895. In 1900 the output was about 1,660,000 tons and in 1905, the output had gradually increased to over 1,745,000 tons. In 1907 the best reports show a total output of over 2,000,000 short tons. A general discussion of the more important coal properties in the different counties will now be taken up.

Beaverhead County—This county is located in the southwestern part of the State and has three fairly distinct coal areas. The first, or "Pioneer" area on Pioneer creek has a seam 10 ft. thick, and is a high-grade lignite. At present this field is worked but little owing to its great distance from a railroad. The area is of fair size and the following is an analysis of the fuel mined:

Moisture	11.55	per cent.
Volatile combustible matter	38.25	" "
Fixed carbon	39.92	" "
Ash	10.48	" "
Total	100.20	" "

The second area is known as the "Medicine Lodge" and "Horse Prairie" lignite beds, and is located from 25 to 30 miles southeast of Dillon. The fuel is a fair grade lignite and the seam varies from 3 to 10 ft. thick. The third area occupies the southern part of the county and is found on Muddy creek, in Sheep creek basin, and a little west of Monida. The deposit is lignite and the seams are not thick.

Broadwater County—But three small areas are found in this county, one is located three miles south of Toston, yielding a variety of coking coal, but not of sufficient quantity to work with profit; another, one mile west of Lombard probably contains a coking coal, but is too badly faulted for extensive development; the third area is about six miles north of Toston and contains a good lignite fuel, ranging from 4 to 6 ft. thick. The only place, however, where actual development is going on is the district near Lombard. At present it cannot be said that this county has much of a future for the production of either coal or lignite.

The Field of Greatest Activity

Carbon County—This county is the second largest coal producer in the State. It has several large properties and many small ones. Almost the entire southern part of the county is underlaid with a fairly good grade of coal. The Northwestern Improvement Company at Red Lodge is the largest producer in the State. This property produces over a half million tons of good domestic and steam coal each year. Some of the other properties in the county are the Bridger Improvement Company at Bridger; the Gebo Coal Company at Gebo; the Bear Creek Coal Company; the Montana Coal and Iron Company; the McCarthy Company; the Amalgamated Copper Company, and several smaller mines at Bear Creek; the Joliet Coal Company near Joliet is also producing. All of the companies mentioned work from 200 to 250 days in the year.

The Northwestern Improvement Company has the best equipped mines in the State. The haulage is done by electric motors, mules and gravity. The mines are lighted by electricty generated by the company's plant. Two tipples are generally in operation handling coal from the two entries. The product is cleaned by means of a 600-ton Luhrig washer constructed in 1903; the equipment includes eight spiral separators of the Pardee type, also a revolving dump, shaking screens

FIG. 1. NORTHERN PACIFIC PLANT AT RED LODGE, MONTANA

FIG. 2. NEW SPIRAL WASHER AT RED LODGE PLANT

*University of Montana, Missoula, Mont.

and picking tables. A gravity box-car loader was finished and put into operation early in 1907. The ventilation is good: both steam and electric fans are used. Another large plant by the same company is being constructed west of the city of Red Lodge. This property bids fair to eclipse the one east of town in size and in output. About 700 men are employed by this company and the annual output is gradually increasing. There are eight seams of coal at Red Lodge, and six of the eight are at present being worked. Seam No. 4 is the one mostly developed. The following is a proximate analysis of the Red Lodge coal:

Moisture	2.420 per cent.
Volatile combustible matter	36.701 " "
Fixed carbon	50.054 " "
Ash	10.823 " "
Total	99.998 " "

The Bear Creek mines or the Bear Creek area is in reality a part of the Red Lodge or Rocky Ford field. The seams, however, have a less dip (4 to 6 deg. to the west) while the Red Lodge beds dip about 18 deg. to the south. Most of the seams are a little cleaner than at Red Lodge and all of the properties are well equipped both inside and out. The coal is shipped to all points of the State and at present sells for $8.50 per ton. The Yellowstone Park railroad connects this area with the Northern Pacific branch line at Bridger. The main difficulty with the properties at Bear Creek is in getting a sufficient number of cars to handle their output. The coal is considered as one of the best for domestic purposes in the Northwest. The mines at Bridger, Gebo, Fromberg and Joliet are all in one area, but not the same as the Bear Creek mines. There is but one seam in this latter area, measuring about 5 ft. in thickness. The Fromberg and Joliet properties employ but few men and consequently have a limited production.

THE DISTRICT OF GREATEST PRODUCTION

Cascade County—This county is the largest producer of coal in Montana. Since the Bear Creek mines are now working full force, Carbon county will probably pass Cascade in the tonnage mined in 1908. Each county will produce nearly 1,000,000 tons at the present rate of output. Some of the more important producers in Cascade county are, Cottonwood Coal Company, Sockett, (Great Northern Railway Company); Anaconda Copper Mining Company, Belt; Nelson-Jenks Coal Company, Sand Coulee; the Gerber mines, Sand Coulee; the Lewis mines; the Orr mine; the Millard mine, Belt; the Richardson mine, Armington, and the Stainsby-Latham Coal Company, of Sand Coulee. Only the first four are at present important mines while the Cottonwood company is the largest of the four. This last company is owned and operated by the Great Northern Railway Company, and produces more than 500,000 tons of coal annually. The seam is about 9 ft. 6 in. thick and is a hard and solid mass throughout. The bed contains numerous "sulphur balls" of iron-pyrite nodules, ranging in size from a pea up to 3 or 4 in. in diameter. Five mines have been opened, three having already been worked out. The coal is a low-grade bituminous, and when cleaned makes a good steam and domestic fuel. The output is about 2000 tons per day and is mined largely by machines.

The next mine of importance in Cascade county is the one owned by the Amalgamated Copper Company at Belt. Heretofore, part of the coal from this mine has been coked, there being in operation here 100 coke ovens. The seam is the same as that found at Stockett, but not quite so thick. The coal production is about 250,000 tons per year, and is mined mostly by machines.

The third important mine in this county is the Nelson-Jenks Coal Company at Sand Coulee, also on a branch of the Great Northern Railroad. This mine produces about 150,000 tons annually; the company employs 175 men. The mining is done mostly by machines. The seam is 10 ft. thick with but few partings. The fuel is good for gas and steam purposes and is sold almost entirely to the Great Northern Railway Company. The following is an analysis of the Sand Coulee Coal:

Moisture	3.66 per cent.
Volatile combustible matter	30.88 " "
Fixed carbon	55.50 " "
Ash	9.96 " "
Total	100.00 " "

The other companies located in this county are in the early development stage. There are many fairly good prospects and the county as a whole has a good future in the coal-mining industry.

Chouteau County—Lignite is known to exist in many localities in Chouteau county, but in most places the deposits are so far from a market that many good seams remain entirely untouched. Near Havre and Fort Benton are the principal lignite mines. Several good prospects are located near Havre, and some of these beds are now being worked.

The Havre Fuel Company is now operating a property three miles north of the city and supplies a good grade of lignite to the local trade. The Alcot mine and another property owned by Mr. Hadalin are also north of Havre, and each is producing more or less lignitic fuel, which has a ready market at Havre and some of the near-by towns. The seam here is from 4 to 6 ft. thick. There are several small properties south of Havre each producing a few hundred tons annually. Owing to the high freight rates, the low fuel value and the great slacking property of the lignite found in the State, its use at long distance from the mines is prohibited. An

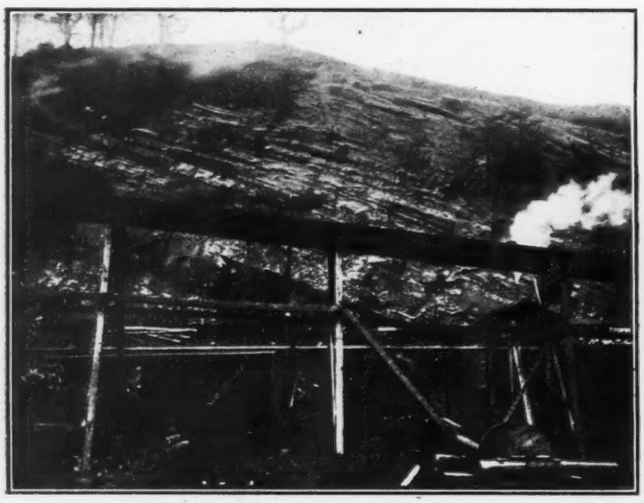


FIG. 3. COAL STRATA AT RED LODGE, SHOWING DIP

FIG. 4. LOADING LIGNITE NEAR MILES CITY, MONTANA

approximate analysis of the Chouteau lignite is shown below:

Moisture	15.225	per cent.
Volatile combustible matter	35.490	" "
Fixed carbon	39.240	" "
Ash	10.000	" "
Total	99.955	" "

The Large Lignite Deposits

Custer County—There is propably more lignite in this county than in any other part of Montana. The deposits are found from Miles City on the north to the source of Powder river on the south. Ekalaka, Powderville and scores of other places show where lignite beds have been opened and used for domestic purposes. There is hardly a ranch or town in the county but has its lignite bed near-by. In Miles City, the largest town in the county, lignite is mined within a few miles of town, and is used almost entirely as the city's fuel. The electric-light plant uses it for generating steam, the large buildings use it in their furnaces, and as a domestic fuel its use is general. The following is a proximate analysis of the Miles City lignite:

Moisture	14.752	per cent.
Volatile combustible matter	34.439	" "
Fixed carbon	42.439	" "
Ash	7.880	" "
Total	99.999	" "

Dawson County—This is another county producing lignite. It is similar to Custer county in having large areas and thick seams. The fuel is being mined near Glendive, on Glendive creek, near Wibaux, and at many other places. Many of the deposits are exceptionally free from bone and have a splendid covering.

Fergus County—This county is among the producers recently developed. The existence of fuel deposits in Fergus county has been known for some time. Coal has been mined for a number of years, but only in a desultory way. Of late, however, there has been considerable activity in the coal-mining industry, and within a few years the production of this district will doubtless rival many of the older and larger producers of today. The coalfield is somewhat triangular in shape and almost completely surrounded by the Judith mountains. The coal is a fair-grade bituminous variety. The seams are not thick, but cover quite an area.

Among the most promising mines in Fergus county are the Spring Creek Coal Company, only a mile from Lewistown, the Montana Coal Company, the Sharp mine, the Stevens & Gilkerson mine, the Black Diamond mine, the Hamilton mine and others. The coal mined is used for both steam and domestic purposes. None of the mines in this part of the State are large producers. From 500 to 15,000 tons per year is the minimum and maximum production for any of the present operators.

Gallatin County—Several areas are found in this county. There are at present five large producers in operation; the Northwestern Improvement Company at Mountain Side, the Washoe Coal and Coke Company, at Storrs, the Mountain House Coal Company, the Trail Creek Coal and Land Company, and the Maxey mine at Chimney Rock. The mines at Mountain Side (Chestnut), are the largest producers in Gallatin county. The coal is of good quality and easily mined. There has been much faulting of the strata, and the proposition of mining is not an easy one. Most of the coal is used on the Northern Pacific engines. The seam varies in thickness from 5 to 20 ft. The dip is from a few degrees to vertical. Neither machines nor blasting are necessary. While the coal has never been tested, it is undoubtedly a coking variety. About 50,000 tons are produced annually, and 150 men are employed both inside and out, working on the average of 260 days each year.

The property at Storrs is owned and operated by the Amalgamated Copper Company, and the coal is coking. The equipment of this property is first-class. Nearly $1,000,000 have been spent at this place to build a modern, well equipped plant. The large hotel and store building, as well as the miners' cottages, are owned by the company. In fact the entire town of Storrs belongs to the Amalgamated. The cottages are modern and have many conveniences, including electric lights. Two hundred coke ovens are in process of construction. One hundred ovens were completed some time ago and are now in use. The seam is badly faulted, and the property has not been a paying proposition. All of the coke that is made here is used by the Amalgamated company in their smelters in Montana. At present the mines and coke ovens are in operation, the first time in three or four years. Analysis of the coal mined at Mountain Side is as follows:

Moisture	8.64	per cent.
Volatile combustible matter	23.10	" "
Fixed carbon	50.18	" "
Ash	18.08	" "
Total	100.00	" "

FIG. 5. AMALGAMATED COPPER COMPANY'S COAL PLANT, AT BELT, MONTANA

FIG. 6. INTERIOR OF LIGNITE MINE NEAR MILES CITY. SHOWS GOOD ROOF

Lewis and Clark County—Almost the entire northern part of this county is underlaid with seams of good bituminous coal. The Great Falls field passes through the northern portion from southeast to northwest. Not much systematic prospecting has been done in this field. Near Augusta, in the northern part of the county is found some of the best coal in the State. There are several mines in this neighborhood, but only the simplest kind of development work has been carried on. The seam near Augusta is several feet thick and quite clean. From simple tests it appears to be an extremely good gas coal. Fuel deposits are also found north of Helena at the base of the Rocky mountains. Semi-bituminous coal is also found near Rock creek. Coal mined near Augusta gave the following analysis:

Moisture	1.763	per cent
Volatile combustible matter	40.770	" "
Fixed carbon	45.914	" "
Ash	11.552	" "
Total	99.999	" "

Meagher County—The Yellowstone field is found in this county. There are several places in the southern part of this district where good seams of coal have been located. East of the Crazy mountains are some beds which belong to the Clarks Fork area. Several seams occur at the base of Castle mountain about 20 miles southeast of White Sulphur Springs. One of these, near the fork of Checkerboard creek has been worked, at intervals, for a number of years. The coal is a bituminous variety and several hundred tons have been mined and used in White Sulphur Springs. Other outcrops are found on Warm Springs creek, and at Sixteen Mile creek is found one of the best beds in Meagher county. The thickness of the seam is about 8 ft. with 5 ft. of clean coal.

Park County—The principal mine in this county is found at Aldridge. The property is owned by the Montana Coal and Coke Company and the coal produced is largely a bituminous variety. Aldridge is located about three miles from Electric, the nearest railroad point. At Electric the company's coke ovens, 225 in all, are situated. There has been considerable development work done at the mine and the main entry is in several thousand feet. All of the coal is of good quality when mined. No machines are necessary. The product is not a good domestic fuel, but part of it is a fair blacksmith's coal. The haulage is done chiefly by electricity. The ventilation and drainage are fairly good.

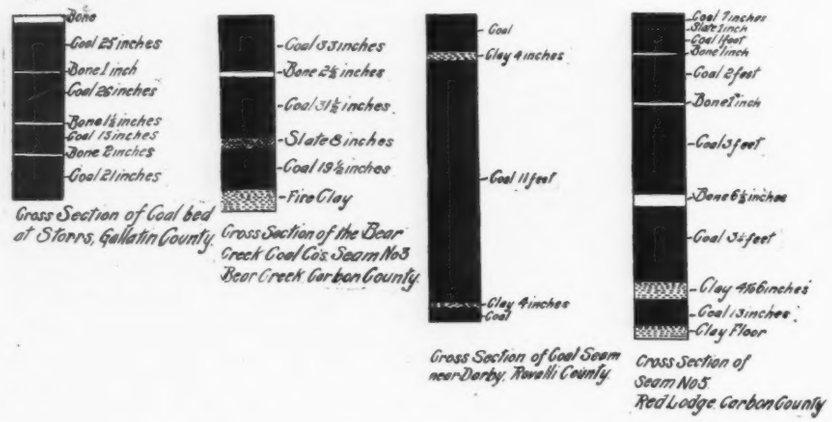


FIG. 7. COAL SECTIONS TAKEN IN VARIOUS PARTS OF MONTANA

Transporting Coal By Means of a Sluice

The coal passes from the tipple to the Luhrig washer at Aldridge and is then conveyed to the large bunkers near the coke ovens at Electric, a distance of over two miles, by means of a water sluice, 12 to 14 in. square. At present all coal must be crushed to a buckwheat size in order to send it down the sluice to the bunkers. The elevation from the washery to the bunker is over 1000 ft. and the flume or sluice is laid to suit the contour of the ground most of the way. From 240 to 280 tons per day of raw coal are sent to the washery and not more than 140 to 170 tons are saved. The balance is in impurities thrown out by the jigs, but mostly by the loss of fine coal suspended in the water going out to the rock dump and the overflow from the bunkers at Electric. To operate the washery and this flume, it requires about 350 gal. of water per min. This would not be necessary in the washery, but the quantity is needed to force the coal over flat places in the flume. The more water used in the flume and washery, the greater the loss of fine coal, as the product does not have time to settle. There are two big settling tanks, however, 60 ft. by 200 ft. each, into which all of the water from the bunker is led, and after settling, the coal is saved and the water drawn off comparatively clear. This prevents most of the silt from flowing into the Yellowstone river into which the water is finally drained. This feature alone makes the plant an interesting one.

The mines are lighted by electricity. The plant that furnishes this power is owned by the company and is equipped with four 150-h.p. boilers, and two 500-volt generators. The output of the company is 10,000 tons of coal per month. About 1.7 tons of coal are used for one ton of coke. Each oven is charged with from 5½ to 6 tons of coal and runs 72 hours. The coke is shipped to Butte, Anaconda and Great Falls and a little to points outside of the State. There are many other small properties in Park county, but none at present of sufficient size to mention. The following is an analysis of the Aldridge coal:

Moisture	0.97	per cent.
Volatile combustible matter	30.60	" "
Fixed carbon	58.00	" "
Ash	10.43	" "
Total	100.00	" "

None of the other counties in Montana are producing much commercial coal or lignite. In Powell county a few years ago, the Mullan Pass Coal Company mined some lignite near Mullan Pass, but the product was only a fair grade lignite and nothing has been done on this property in recent years. In Ravalli, Granite, Madison and Rosebud counties there are several lignite areas, but these have not yet been extensively developed.

Statistics of Montana's Coal Industry

The manner of mining coal in Montana has advanced from simple pick mining in 1880, to present modern methods of machine mining. Last year more than one-half of the coal tonnage of the State was produced by machines, and the average per man for the year was above 545 tons. There are now about 55 operators, both large and small, in the State, and many new companies are organized each year. About $6,000,000 is now invested in the coal properties of Montana; one-half of this sum represents the value of the annual product; nearly a third of the amount invested is paid each year for wages. There are now 550 finished coke ovens in the State and three mines produce practically nothing but coking coal. The value of the annual production of coke is about $300,000.

The following scale of wages applies to all of the mines operated in Montana:

Outside Men.

Engineers, 1st class	$4.00	per day
Engineers, 2d class	3.50	" "
Water tender	3.25	" "
Fan fireman	3.25	" "
Blacksmiths	3.75	" "
Blacksmith helpers	2.75	" "
Carpenters	3.75	" "
Car repairers	3.50	" "
Car repairers' helpers	2.75	" "
Machinists, 1st class	4.00	" "
Machinists, 2d class	3.50	" "
Coal inspector	3.00	" "
Drivers	3.00	" "
Head dumpers	3.00	" "
Barnmen, in charge of more than 16 head of stock	$95.00	per month
Barnmen, in charge of less than 16 head of stock	80.00	per month
Teamsters	$3.00	per day
Jigmen	3.25	" "
Other washermen	2.75	" "
Greasers	2.30	" "
Coke men	2.75	" "
Larry car operator	2.85	" "
Motormen	3.50	" "
Outside labor, not classified	2.75	" "

Inside Men.

Miners	$3.75	per day
Timbermen	3.25	" "
Timbermen's helpers	3.75	" "
Tracklayers	3.75	" "
Tracklayers' helpers	3.25	" "
Bratticemen	3.75	" "
Shooters or shot firers	3.75	" "
Machine runners	3.90	" "
Machine runners' helpers	3.40	" "
Drillers	3.75	" "
Drillers' helpers	3.25	" "
Machine repairer	4.00	" "
Pipe foreman	3.75	" "
McGinty repairer	3.75	" "
Drivers	3.60	" "
Inside engineer	3.25	" "
Rope riders	3.40	" "
Rope riders (main rope)	3.75	" "
Trappers	1.60	" "
Pick carriers	2.25	" "
Pumpmen	3.75	" "
Inside labor, not classified	3.25	" "

In the matter of mining rates per ton, the pay of the miners varies from 40c. per ton of 2000 lb. mine-run, to 76c. per ton, according to the location and character of the seam. Crosscuts and other places under 10 ft. in width are paid for at the rate of from 50 to 60c. per lineal foot in addition to the coal. Where crosscuts exceed 25 ft. in length, they are paid for at the rate of from 75 to 85c. per lineal foot.

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

France now requires about 18,000,000 tons of foreign coal to make up her annual consumption of 54,000,000 tons.

The death rate in the coal mines of Ohio during 1907 was higher than ever before; there was an increase of 20 per cent. over that of 1906.

The record for 1907 in the first anthracite district of Pennsylvania shows that falls of roof caused 71.8 per cent. of the total number of inside mine accidents during the year.

The Canadian Northern Railway Company is conducting experiments with a special design of smoke stack for the use of lignite coal on their locomotives. At present the Railway Commission forbids the use of this coal during the summer.

Cleveland holds the record of having loaded the largest cargo of coal ever carried by a lake boat. The steamer Legrands De Grafi recently sailed from the Ellsworth dock with a cargo of 12,441 tons, which is 600 tons over the best record of 1907.

Undercutting pillars calls for great care, for if they have been crushed or cracked by the roof pressure, blow-out shots will be of frequent occurrence, since the tendency is for the energy of the powder to expend itself on the air through the cracks instead of affecting the coal.

Geological surveys conducted by the Canadian government and various private parties, have disclosed the fact that in the province of Alberta, on the eastern slope of the Canadian Rockies, there exists an undeveloped coalfield said to be of greater area than the entire State of Pennsylvania.

Leather belts if not oil-soaked should be painted on the outside with some good lubricant, applied with a brush; the outside of belts has to stand a great strain and must be soft and pliable in order to wind around the pulleys. Treat a new belt thus every other day for two or three weeks until it is thoroughly saturated.

The number of accidents in the anthracite field due to roof falls, strengthens the belief that it is advisable to have in every colliery, trained men whose sole duty it is to make a daily inspection of the roof of each working place and gangway, and to prohibit miners from working in places found to be dangerous until the roof is carefully propped.

The French government has resolved to confer crosses of the Legion of Honor on the engineers who distinguished themselves in the great Courrieres disaster in 1906. The fire which resulted from this explosion is still burning, but a circle of clay barriers through which tubes are inserted to let off the gases, have completely isolated the burning district.

If water in a boiler is dangerously low, do not attempt to draw the fires, for during this process, an intense heat is raised which is destructive to the boiler plates. It is best to smother the fires with damp sand or earth. Never put on the feed as this causes a sudden contraction of the plates which rends the joints and sometimes causes the boiler to explode.

Something of the growth and importance of the anthracite coal trade of Pennsylvania may be realized from the following item, which appeared in 1858 in a newspaper of the anthracite region: "The Delaware & Hudson Canal for the Pennsylvania Coal Company, sent to market last year 480,678 tons of coal at a profit of $685,386. Coal is selling in New York by cargo at $3.70 to $4.40 a ton."

The method of nullifying the effect of dust explosions by the creation of a dustless dry zone with arched roads, is not practical in all deep mines as such arches cannot always withstand the tremendous earth pressure, and, therefore, require constant renewal. In such mines a safety zone is sometimes formed by plastering the sides and covering the roof with wood, thus keeping the road in such a state as to enable it to be occasionally swept.

When the freezing method of shaft sinking is employed and quicksand is met with at a considerable depth, the abnormal expansive force exerted by the sand and water when freezing, is liable to burst the freezing tubes. This may be prevented by putting down a bore-hole in the center of the proposed shaft to act as a relief to the varying degrees of expansion in the different strata. The temperature and rise of the water can also be noted by means of this bore-hole.

When belts are used in transmitting an intermittent load, or where the load is on and off at short intervals, such as belts on gas engines, etc., it is advisable not to run too slack a belt, but simply to run it easy. It should be remembered that a slack belt is not desirable unless it is properly oiled to increase the adhesion between the belt and pulleys. Such treatment will, under given conditions, cause a belt to transmit more power than an untreated belt at the same tension and speed.

Thaw houses should be built of concrete or brick with either iron doors or an earth barricade in front of the doors. A good thermometer should be placed in all thaw houses where it can be seen whenever the front doors are opened. Double or single floors may be used for such houses; in the latter case, the space below the floor should be filled with cinders. Shelves should be provided on which to spread the cartridges, as they thaw more satisfactorily when spread out than when kept in the boxes.

When running a freezing machine for shaft sinking, it is of the utmost importance to make certain that every part of the system is working properly. When the machines are first started, ice soon forms on the pipes; to ascertain if the machine is working properly, clip off a few square inches of this ice until the pipe is exposed in several places. The rapid formation of ice upon the exposed parts is proof of satisfactory working. A test may also be made with alcohol thermometers placed in intermediate shallow bore-holes filled with brine.

A successful test of the Draeger lifesaving apparatus was recently made in a mine near Scranton, Penn. A mine gangway was allowed to fill with gas. Two volunteers fitted out with helmets explored the gangway and chambers branching from it and suffered no ill effects from the gas. Apparatus of a similar kind was used in the rescue of the miners at the time of the Courrieres disaster in France. One of the principal advantages of this machine is that the wearer can be easily heard when speaking to a companion rescuer. The apparatus is capable of supplying air for two hours without replenishing.

The jumping of belts is often due to the use of metal fasteners on small pulleys; these fasteners are likely to cause unevenness of delivery. Lighteners on belts increase the friction, cause loss of power and call for an additional consumption of oil. Heated bearings are often a cause of belts slipping. Endless belts give the best results on dynamos. Soap and water only should be used for washing rubber belts; the use of castor oil on belts is not advisable because of its extreme gumminess which in time dries and cracks, causing the belt to crack also. Only the best grade of naptha or gasolene should be used in cleaning belts, as the low grades contain oil which leaves the belt greasy.

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Illustrated.

Production of Copper in the United States in 1907

Our revised statistics show that the production of copper in the United States in 1907 was 879,241,766 lb., against 917,620,000 lb. in 1906. The statistics for 1907 are based on reports from all of the Michigan mines and all of the other smelters as follows: (1) Refined copper obtained from the "mineral" produced by the Michigan mines during the year; (2) fine copper content of the blister copper produced by the smelters; (3) to a small extent, the copper content of ore and matte (with a suitable allowance for loss) treated by Eastern smelters and the copper content of bluestone made directly from matte. The Eastern smelters treat mainly material from foreign sources, and rather than attempt to distribute their blister-copper production according to origin, it has been considered safer to reckon the copper content of the ore and matte which they received from domestic sources, the major portion of this material being matte, a smelter product which is already high in copper. The total of the copper thus reckoned is less than 2 per cent. of the whole production. Thus the statistics for 1907 have been computed on a more uniform basis then ever before by ourselves or any other statisticians.

Although the effort has been to conform to the above basis in previous years, it has been impossible to avoid the incorporation of some reports submitted on the basis of refined copper, which have introduced certain confusion as to time. Blister copper from the West is in transit, and process of refining for an average of 60 days after shipment from the works of origin. Consequently, the statistics of the production of refined copper and of blister copper are for different periods of time. Statistics of the production of refined copper show the metal made ready in final marketable form, but such statistics for any calendar year represent the metal shipped from the Western smelteries during the year ending Oct. 31, or even earlier. The statistics of blister-copper production are therefore more nearly representative of the production of the mines; in fact, as near, we think, as it is possible to go. Moreover, blister copper is a product that is never shipped from one smelter to another; its destination is invariably to a refiner; consequently, statistics computed on this basis eliminate danger of duplication about as far as is possible, but not entirely, inasmuch as certain refiners work up their by-products in such a way that their copper content appears a second time as blister copper. Many of the Eastern smelters purchase considerable quantities of scrap metal, which appears in their statistics. These items are deducted from their reports so far as possible, and in the statistics for 1907 we believe there is but little, if any, overstatement on these accounts. On the other hand, it is to be remarked that all the copper in blister does not appear finally as refined metal, a portion of it (very small, however) going into bluestone, a by-product of the refining process.

The statistics of production in 1907 by smelters are given in the following table. It has been necessary to make certain combinations in order to avoid the disclosure of individual production in States which have only one or two smelters each.

PRODUCTION OF COPPER IN 1907.

Group.	Number.	Pounds.
Michigan mines	20	220,317,041
Smelters in Arizona and Texas	9	262,597,624
Smelters in Montana and Wyoming	5	229,362,164
Smelters in Utah	5	90,100,052
Smelters on Pacific coast	7	21,936,026
Smelters in Mississippi valley	3	24,062,550
Smelters on Atlantic coast	4	13,640,930
Smelters in Tennessee	1	14,784,379
Miscellaneous (*a*)	..	2,441,000
Total		879,241,766

a Includes exports of ore and matte and copper produced by lead desilverizers.

The distribution of production according to States is made from the above table; all of the smelters report the origin of most of the ore and matte which they converted into blister copper. In the case of matte purchased from other smelters, the latter have reported the origin of the ore which they turned into matte. In general the reports of matte shipped and matte received have agreed very well, similarly as to ore received and matte shipped, but in some cases there are discrepancies, which are explainable, of course, by additions to, or drafts from, stock on hand. This shows why it is impossible to carry statistics of production clear back to the mines themselves. On the other hand, reports from the mines are of comparatively little value, because they seldom know how much of the metal is extracted from their ore, and often do not know how much metal their ore contains. The statistics based on the blister-copper production are most representative of the production of the mines in the aggregate, but the allocation of the pro-

duction according to States of origin can never be precise, although in most cases it can be arrived at closely. Our distribution of the production in 1907 is given in the following table:

PRODUCTION OF COPPER BY STATES.
(In Pounds.)

State.	1906.	1907.
Alaska	8,700,000	6,610,680
Arizona	263,200,000	256,866,761
California	24,421,000	34,398,823
Colorado	9,565,000	13,344,118
Idaho	9,493,000	11,471,101
Michigan	224,071,000	220,317,041
Montana	299,850,000	226,290,873
Nevada	426,000	1,462,450
New Mexico	6,262,000	8,652,873
Utah	49,712,000	68,333,115
Wyoming	146,000	2,919,137
South and East (*a*)	18,821,000	22,408,696
Other States (*b*)	2,953,000	6,166,098
Total	917,620,000	879,241,766

a Includes Maine, Massachusetts, Vermont, Virginia, North Carolina, Alabama and Tennessee.
b Includes Oregon, Washington, South Dakota, Texas, Missouri, and also considerable quantities of copper, reported by the smelters, originating in States elsewhere enumerated of which the precise origin can not be traced.

There is one particularly noteworthy feature in the above statistics. This is the remarkably large output made by certain States which have not heretofore figured as copper producers of any consequence. Some of these have had to be grouped in order to avoid the disclosure of identity, but it may be remarked that Alabama, North Carolina and Virginia produced nearly 2,500,000 lb. of copper in 1907; Wyoming produced upward of 2,900,000 lb.; Nevada produced nearly 1,500,000 lb.; Vermont produced nearly 700,000 lb., and Missouri figured with a substantial output. These figures show the great stimulus of a high price for copper in bringing out production from many small mines which normally can not be worked at a profit. The same condition is reflected in the statistics of the States like Colorado and New Mexico whose ore goes chiefly to custom smelters. The high price prevailing during the major part of 1907 led to the operation of many little mines, whose output was large in the aggregate. Since the price passed under 15c., many of these have ceased to operate.

The Conservation of our Natural Resources

The convention of governors and their advisers, together with many of the leading engineers of the United States, at the White House, last week, was perhaps an epoch-making event. The calling of this conference was one of Mr. Roosevelt's happiest suggestions, and we predict that its results will redound to his fame. Engineers and economists have long recognized that there is a limit to our natural resources, some of which like the minerals cannot be replaced, and we have been drawing upon them in a reckless way and to a more or less extent wasting them. Indeed, the waste that occurs in our industrial and social life is appalling, not only the waste of material, but also the waste of life. Our nation would become immensely richer if the wastes were reduced even by a small percentage. However, reference to the waste of material must not be inconsiderately made; a good deal of what is commonly referred to as waste is not really so. The minerals are discovered and mined in order to be used. Their extraction is determined by economic conditions. Hence it may easily happen that it is cheaper to leave irrecoverably in the ground 25 per cent. of a mineral than to win the whole amount. It is undeniable that at some future time the value of the mineral may be so much increased that it would be economical to win 90 or 95 per cent., or even 100 per cent., but if our undeveloped resources were allowed to remain untouched for a long period of time, the interest charges upon the capital invested in them would accumulate to such an extent that the result might conceivably be financial loss. In this light the failure to extract all of the mineral of a mine is not necessarily a waste. This question was not discussed at the recent conference, although President James, of the University of Illinois, referred to it.

Nevertheless it is indisputable that we have made, and every day still are making, unnecessary wastes. Particularly disgraceful has been the destruction of our forests, with but comparatively few efforts to replace them, and those not until recently, the result of which is already manifest in the increased cost of lumber. Moreover, we have allowed, and are still allowing, our natural resources to pass into the hands of speculators, who aim to hold them and dispose of them for the use of posterity, which will thereby be saddled with immense interest charges. These things have heretofore received comparatively little attention. At the conference, the governors stated frankly that the information there communicated to them was a revelation, and two governors announced that immediately upon their return home they proposed to appoint forestry commissions. This is illustrative of the prime purpose of Mr. Roosevelt in calling the conference, which was intended to be educational. As such it was a great success. Moreover, it was educational in precisely the quarters where most good could be done. Everyone is now conversant with the manner wherein an intelligent, high-minded executive can force upon a reluctant legislature policies that are demanded in the interests of the people. The conference at Washington has awakened the leading representatives of the people to the dangers that threaten their interests, and those of posterity, and we believe that the utilization of our natural resources will hereafter be regarded in a different spirit than heretofore. An important feature of the conference was the prominent part assigned to the engineers and the deference to their opinions. In carrying out whatever plans that may be developed from the conference it is to be hoped that the Federal and State executives will continue to put their reliance upon the engineers of the country.

Supply and Demand

The present industrial depression is evolving some peculiar ideas in political economy. First we were presented with the thesis that prices subject to more or less control (on a rising market) must not be reduced because jobbers and manufacturers who had contracted for supplies still undelivered would suffer if anyone else were permitted to buy cheaper. Next Samuel Gompers declared that the prices of all commodities might come down, but the wages for labor must not be reduced. Then Judge Gary announced that the fact that demand is less than supply does not furnish an argument for lowering the price of commodities. Apropos of this, the *Evening Post* remarked that if there is no reason why prices should change in response to changed relations between supply and demand, mercantile trade in general is now and always has been based on an absurdity. "From this assumption there would be only one step to an advance of prices in the face of increased supply and reduced demand." Who would have believed that when the *Post* made that remark, about a month ago, the railway managers would in a few weeks be considering that very thing? Yet they have seriously proposed to increase freight rates because business is slack. After more mature thought, they will probably decide not to attempt it, but the mere fact that they have considered it illustrative of

the new vagaries that are pervading minds.

The erratic thought of the railway managers is obviously due to the embarrassing corner into which they find themselves driven. Traffic has diminished seriously, the statistics at the end of April showing a total of 413,338 idle freight cars, an increase of 37,714 since April 15. On the other hand, expenses show comparatively little falling off, which causes net earnings to suffer in an alarming way. The natural development, many months ago, would have been a reduction in wages, but in the face of the declarations from Washington the managers simply do not dare to make it.

According to the theory of M. Leroy Beaulieu, the eminent French economist, which is the most competent explanation of the reason for the present world-wide industrial depression, it is necessary for the population of the world to accumulate savings to make good the recent losses of capital, and supply what is necessary for enterprises already undertaken. In this light the people ought to be busy, rather than to have a large proportion of the workers idle in order that the remainder may continue to earn extravagant wages. The wasted time of these idle men is a direct loss to the world. We have seen the combinations which aimed to maintain prices, bow to the adverse wind, one after another. Even the Steel Corporation appears now to be wavering; at least to be seeing business going to its smaller competitors who are cutting prices. Even the labor unions in many places have accepted reductions in wages with intelligent appreciation of the conditions, in spite of Mr. Gompers. This has been to great advantage, not only to them, but also to industry in general. Look at Butte, for example, where the cost of producing copper has been reduced from 12c. per lb. or more, to about 10c. per lb., partially through a moderate reduction in wages, and partially through increased efficiency of the men. It is absurd that the railways should not be free to conform to the natural law of supply and demand, which sooner or later they must do anyway. That law may be trifled with for a little while, but in the long run it cannot be balked any more than water can be made to run up-hill.

The *Economist's* index number of average prices of commodities at the beginning of May was 2195 against 2263 at the first of April. The average on May 1 was the lowest since Aug. 1, 1905, and shows a decline of 15.6 per cent. from June 1, 1907, when it was 2601, being the highest of any month or year since 1876. This shows how the natural law is working in spite of the efforts to defeat it. What we need most at the present time is industrial freedom, including the reversal of the policy of certain great trade combinations to refuse lower prices for material and the discontinuance of the intrigues of the labor unions, at Washington and elsewhere, to maintain wages at the maximum of the "boom time" which no longer exists. Those are the things which are holding back recovery in business. The prices of many commodities have fallen to attractively low figures, but we must see a decline all around, so that consumers will be led to buy and the foundation for a sound recovery in business will be laid. The artificial sustaining of prices, which in the long run is bound to fail, will in the meanwhile only retard recovery.

The Bureau of Mines Bill

The present outlook is that the bill to create a bureau of mines, now before the House of Representatives, will fail to pass at this session, whereof the remaining time is short and the political interests are many. The mines bill has no political interest and therefore is unlikely to be considered. Indeed it appears to have lost much of the limited interest that it ever had. There was a time when the coal miners and operators were brought into advocacy of the bill and in fact they played the principal part in the hearings before the committee, but the suggestion that John Mitchell might be the commissioner of mines caused the operators to pause and reflect. If a professional labor leader, however estimable, were to be put at the head of a bureau whose organic law afforded abundant opportunity for mischief to the industry it would obviously be better not to create the position.

The dangers that might arise from a bureau of mines under the provisions of the various bills that have been introduced have been repeatedly pointed out by the JOURNAL. We have also indicated the lines that such a bureau might properly and usefully be designed to follow. Such a bill as we have outlined would not only be satisfactory to the portion of the mining industry that wants a bureau of mines, but also would have a good chance for passage.

In the meanwhile, the Geological Survey will probably be given a large appropriation with which its technologic branch is to make a special study of mine explosions. (It is a pity that this cannot be entrusted to a commission of colliery engineers.) But the most gratifying prospect is that the Geological Survey will be granted an increased fund for geologic work. It is to be hoped that this will be secured, for if so the mining industry will indeed have cause for gratulation.

Association of State Geologists

The heads of the geological surveys of the various States met in Washington last week in conference with the director of the U. S. Geological Survey and organized an association, for the purpose of securing uniformity of methods and general cooperation. A committee on nomenclature was appointed, which will endeavor to coördinate the names of geological formations. Plans for coöperation between the Federal and State geological surveys in statistical work were also discussed and a method was tentatively agreed upon. All this is, of course, what should be and marks the broad policy and liberal views, looking only to the advantage of science and industry, which characterize the administration of the present director of the U. S. Geological Survey.

The Production of Coal

According to the statistics collected for the forthcoming volume of THE MINERAL INDUSTRY, the total production of coal in the United States for 1907 was 472,876,848 short tons against 413,822,403 short tons in 1906. This includes anthracite and bituminous. The production of bituminous coal was 386,535,016 tons in 1907 against 341,612,837 tons in 1906. The production of anthracite was 86,341,832 in 1907 against 72,209,566 in 1906. The production of coke was 36,993,622 tons in 1907 against 33,333,039 tons in 1906. The production of anthracite was 86,341,832 in 1907 against 72,209,566 in 1906. The production of coal in the world amounted to the great total of 1,087,579,615 metric tons in 1907 against 988,173,043 metric tons in 1906.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

The Volcan and Garretson Furnaces

It was a coincidence that the article about the Garretson furnace and Mr. Lloyd's description of the Volcan down-draft furnace appeared in the same issue of the JOURNAL. The principle of each of these furnaces was combined in a much earlier furnace, patented by Robert F. Nenninger, with the operation of which I became acquainted in 1890. Mr. Nenninger's furnace, in section, was almost exactly like the illustration shown of the Volcan furnace (JOURNAL, April 11, 1908, p. 763). In addition, however, Nenninger had (as has the Garretson furnace) a double row of tuyeres, one row below the other, the upper tuyeres being the smelting tuyeres, and the lower what might be termed the oxidizing tuyeres. The products of combustion passed out through just such a forehearth as is shown in the cut of the Volcan furnace, which was in effect a small reverberatory. The hot gases, passing over the thin layer of slag covering the matte bath, were highly effectual in cleaning the slag. The slags varied in composition from excessively basic to excessively acid, the latter being glassy and clear colored; and yet the slags were almost absolutely clean, the assays showing only the slightest traces of either silver or lead. But what was most remarkable was that even the irony matte contained only traces of lead. The ore was a zinc-lead sulphide, Mr. Nenninger's effort being to burn off all the zinc and lead, which were to be caught subsequently by sprays of water in cooling and condensing towers, the lead as sulphate, and the zinc to go into solution as sulphite soluble in water containing sulphurous acid.

It was also Mr. Nenninger's idea to use his furnace as a continuous smelting and converting furnace, and in addition to the lower set of oxidizing tuyeres in the furnace shaft he had oxidizing tuyeres below the matte level in the forehearth. Mr. Nenninger found, however, that such a scheme violates a principle in copper matte converting, the same principle being also violated in the Garretson furnace, viz., that a constant inflow of lower-grade matte arrests the oxidization of higher grades and white metal into blister copper, the matte tending to maintain an average grade; in other words, the converting is necessarily an intermittent process. But mattes can undoubtedly be raised in percentage of copper, providing the oxidization of the matte is sufficiently rapid as compared with the inflowing lower-grade matte. Apart from the mechanical difficulties of the Garretson furnace, it was impracticable to arrange a proper inflow, so that it was necessary to draw the matte before it was converted to blister copper. The greatest difficulty, however, was caused by the high pressure blast in the converting end of the furnace.

I had some experience with the Garretson furnace at San Luis Potosi, the Compañia Metalurgica Mexicana having arranged with Mr. Garretson to make a trial run with his furnaces. The converting feature was abandoned after a few trials, but the furnace was occasionally operated as a simple pyritic furnace. It was of interest, however, after my previous experience with the Nenninger furnace, which with its reverberatory forehearth, similar to the Volcan, above referred to, was a much more practical form of furnace. Had Mr. Nenninger applied his furnace for its maiden effort to the smelting of copper ores, instead of to zinc-lead ore, with the subsequent loss of metals due to the impossibility of proper condensation, the financial results would not have been so disastrous to the purchasers of the patent rights, and we should undoubtedly have learned more of the down-draft furnace as a matte concentrating furnace, but not as a complete continuous converting process into blister copper. At any rate, it is interesting to note, as a matter of metallurgical history, that a furnace combining both the Garretson and Volcan features, was in use about 1890 at Laurel Hill, N. Y., and at Thomasville, N. C. R. C. CANBY.

El Paso, Texas, April 21, 1908.

Value of the Blow-pipe Assay

It has become the fashion to despise and belittle the blow-pipe and its possibilities in quantitative work. Many say that it is inaccurate, etc., and our foremost technical school has discontinued instruction in its use. Perhaps I am partial to the use of the instrument, but whenever I hear it berated, I always wonder whether those who oppose its use have ever given it a fair trial in practice.

Upon two exceptionally hard expeditions, when weight on our pack animals had to be cut to the limit, I left behind my kodak and blow-pipe, and both times their absence severely handicapped me in preparing my reports. I do not mean that engineers should report on the strength of blow-pipe results, but I am merely trying to show how it may be useful in the field.

Once, while in the interior of Spanish Honduras, I received some samples of copper ore and was requested to come and examine the mine. The stock of charcoal for our assay furnace had been exhausted and we did not have time to burn a fresh supply, so we fell back upon the blow-pipe, and my result checked up well enough with a fire-assay made later. Unfortunately when we visited the property we found the ruins of an old Spanish reverberatory, and that the ancient miners had gutted the mine, for which, of course, the blow-pipe was not to blame. At another time in the same country I was left alone to examine a gold mine, samples from which had previously been "salted." I secretly sampled alone here and there and put the samples in my pockets. These samples were tabulated and blow-piped each evening when no one was present. The larger samples were sealed as taken, and the assays made by an assistant 100 miles distant checked fairly well with the blow-pipe.

I have spent many an hour in Canada stretched at full length in a tent, coaxing the blow-pipe flame; and a pan and a blow-pipe have saved me many long trips to the assay office with barren samples.

The blow-pipe offers better training for the mind and eye than many of the subjects taught in our schools, and it certainly can be made of practical use.

S. H. BROCKUNIER.

Wheeling, W. Va., April 20, 1908.

Coal-mine Explosions

The coal-mining industry is attended by one great source of danger, which is generally overlooked in our Government and State mine reports: I speak of mine fires. It seems strange that this particular cause of mine disasters should be so generally ignored.

That coal will fire spontaneously is well recognized by all who have had experience with bituminous coal; also, those who have used it in a stove know that under certain conditions, a miniature explosion or series of explosions will take place. If this will happen in a stove where only coal-gas is present, then why not on a larger scale in a mine where both coal-gas and firedamp are found.

A case in point happened at Cardiff, Illinois, in March, 1903. A fire had been

discovered in old workings and stoppings were immediately built to shut out the air and smother the flames. The stoppings had only been in place 8 or 10 hours when there was a violent explosion in which three men lost their lives. Forty hours later another explosion took place killing five men, and 18 hours after this second accident, a third explosion occurred and one man was killed. As a result of these explosions the shaft caught fire and was burned completely out. No firedamp had been found in the mine, and the ventilation at the time was fairly good.

I have read that in the great explosion in France, in which some 1400 miners perished, they had previously walled in a fire; and at Hanna, Wyoming, this spring where about 70 lives were lost, a mine fire was raging and was the probable cause of the disaster. It has been said that, "a philosopher learns from the experience of others, the wise man from his own experience, but the fool from neither," and it seems that if we do not wish to be classed in the last category, we should be careful to stop off with good masonry walls, all entries that have been worked out, and not leave our mine roads open and connected with other parts of the workings to be a constant menace to life and property. It has been proved time and again that it is too late to fight a fire in a coal mine after the flames are well started.

H. N. Dodge.

Gibson, New Mexico, April 13, 1908.

A New Safety Lamp

The recent alarming increase of mine explosions naturally calls our attention to the methods employed in discovering the presence of any mine gas before it accumulates to a dangerous extent. It seems that in this particular, inventors have not kept pace with the demands of the industry; in any case, the only method, other than preventive measures, employed to guard against danger from explosion, is the old safety lamp invented by Sir Humphrey Davy. As far as I can find, there has been proposed but one new method to show the presence of either carbonic acid or gas in mines. It is based on the principle that certain kinds of flame—as, for instance, that of benzine—remain of the same size and brilliancy so long as the medium in which they burn remains unchanged; but if a mine gas is present, the flame will increase in size and brightness. If carbonic acid be in the air, the size and brilliancy will decrease. This theory has been utilized by placing over the flame of the ordinary safety lamp a thermo-electric element which is connected with a galvanometer. If a mine gas is present, the flame will become hotter, and the galvanometer will show the rise in temperature; and if there be carbonic acid present, the instrument will indicate this by a movement in the opposite direction. If the galvanometer is connected with a registering apparatus, there seems to remain nothing wanting to enable the prevention of explosions or other similar accidents, if the warnings be observed; if they be neglected, however, the proof of such neglect will be shown by the apparatus.

Robert Grimshaw.

Dresden, Germany, April 24, 1908.

Coal-dust Firing of Reverberatory Furnaces

Referring to a note in the Journal of May 2 on coal-dust firing of reverberatory furnaces, the oil-fired reverberatories at Humboldt, Arizona, were, as far as I know, the first large furnaces to use oil for fuel, and the results obtained were in some respects quite remarkable as compared with coal-fired reverberatories. It was found quite feasible to run a slag of 48 per cent. silica and 11 per cent. lime, the highest silica in coal-fired reverberatories known to me being 42 per cent.

The running of these high-silica slags, of course, required more fuel, as it was necessary to maintain a much higher temperature in the furnaces; but waste-heat boilers having a large excess capacity were attached to the furnaces and the requirements of the mine and smelter for power were such that the increased consumption of oil and higher escaping temperature of the gases were a direct economy in the production of power. All of the waste-heat boilers were equipped with auxiliary oil burners so that it was possible to maintain a constant steam pressure even when the reverberatory was partly down for repairs. This was necessary, for the mine, and, in fact, the entire smelting and concentrating plant were dependent for power on the reverberatory waste-heat boilers. By this combination of auxiliary burners and waste heat from reverberatory furnaces, we were enabled to avoid the necessity of a double boiler installation as is the case with coal-fired reverberatories.

Cyrus Robinson.

New York, May 13, 1908.

Chief Producing Mines of the United States

Kindly allow me to correct a ridiculous misquotation now going the rounds of the stock market press in New York and Boston, in which I am quoted as having said, while addressing an audience at Spokane recently, that the four largest mines in the world were the Alaska-Treadwell, the Comstock Lode, the Calumet & Hecla and the Bunker Hill & Sullivan.

My remarks on the occasion referred to were confined to the four largest producers of gold, silver, copper and lead in the United States; but even this correction does not straighten the matter out, because I mentioned the Alaska-Treadwell as occupying second place in the production of gold, its total dividends being scarcely more than a half of those paid by the Homestake.

I would be quite willing to forgive the newspaper man for not knowing that the Comstock designated a magnificent ore body and not a mine. Unfortunately, a professional man has no recourse when a newspaper misquotes him, unless that misquotation is malicious in intent, which, of course, would be practically impossible to prove in cases such as this. The only thing left is to square oneself in the eyes of one's professional fellows.

Francis A. Thomson.

State College of Washington, Pullman, Wash., May 12, 1908.

The Divining Rod Again

In investigating the use of the forked twig in locating water, oil and mineral, I discovered one point that seems worthy of mention. I have made out that the action upon the twig in the case of the water finder is muscular, the muscles being caused to operate by a force which passes up through the ground, through the operator's feet to the nerve centers, and from there actuates the muscles, through the nerves supplying the muscles of the hands. The same thing I make out rules in the case of the simple location of metals, the force acting upon the nerve centers being emanations from the metals themselves.

Both in the case of a friend who locates iron and coal, and gentlemen in Nevada, who locate oil and natural gas, there is the very peculiar feature, that the action appears to take place between the mineral and the substance, which is so far kept a secret, carried in the fork of the rod employed. My friend tells me that a rod arranged to locate coal will not locate iron, and neither of them will locate oil. The gentlemen who have written me from Nevada tell me the same thing with regard to oil and gas, the rod for gas will not locate oil, and *vice versa*.

A chemist of my acquaintance informs me that the oils that are found are noted particularly for an absence of affinity with anything; and as the gas which is found is also of somewhat the same nature, I imagine that something of the kind applies to that also.

J. I. Credo.

Kalamazoo, Mich., April 28, 1908.

According to the *Manufacturers' Record*, April 9, 1908, shipments of Peace river phosphate rock, made by the Peace River Phosphate Mining Company, through the port of Punta Gorda, Fla., during the month of March, amounted to 1875 tons, making a total for 1908 of 5255 tons.

Massachusetts Ball-bearing Exhausters

The ball-bearing exhausters of the Chapman double-ball type with single-ball races, manufactured by the Massachusetts Fan Company, of Watertown, Mass., have bearings consisting of case-hardened cups forced into the hanger and case-hardened cones forced upon tapered portions of the fan shaft. Between the two run hardened-steel balls separated by small ball idlers carried in light steel floats. The shaft may readily be driven out through the fan wheel, pulley, and bearings. The bearings are packed in vaseline when shipped from the factory and require no attention whatever, except a semi-annual repacking.

In the smaller sizes the bearing supports form an inherent part of the hanger. The different parts of the bearing are readily taken apart for inspection or replacement. In the smaller sizes the fans are made right- or left-handed or inverted, and also universally convertible; that is, they may be adjusted to discharge in any direction. Comparative tests show a saving of about 10 per cent. in the power required to drive a ball-bearing fan as compared with one fitted with plain babbitted bearings.

The convertible type with bearings formed in the hanger and with overhung wheel is made in sizes up to and including 60 in. diameter of shell. In larger sizes the ordinary form of casing construction is employed and the bearings are, of necessity, independent boxes bolted to the supports. In the larger fans the bearings contain two ball races instead of the single race of the smaller size. The bearings, each of which is entirely independent of the fan, are bolted to cross bars, supported by angle-iron uprights, and both are securely riveted to the fan shaft.

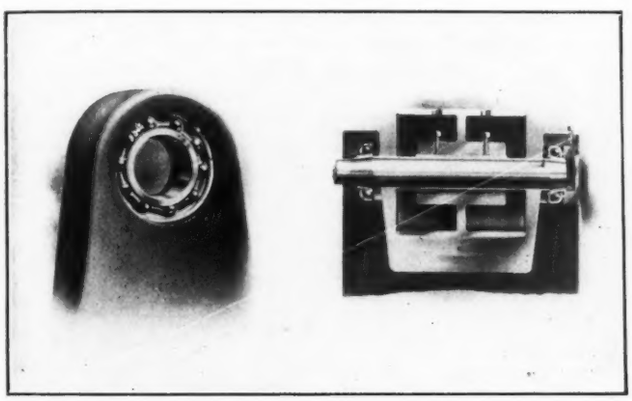
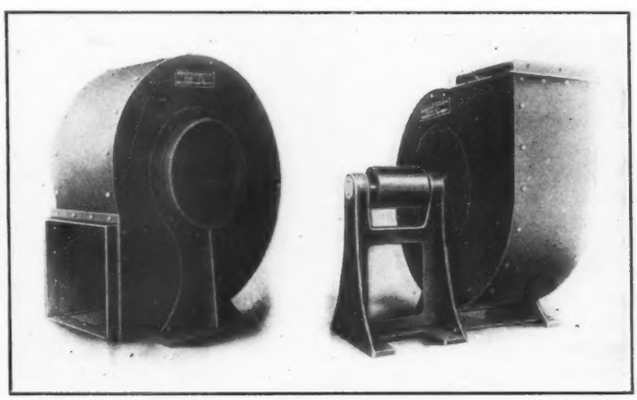


FIG. 1. SECTIONAL AND PERSPECTIVE VIEWS OF BEARINGS



BOTTOM-HORIZONTAL AND UP-BLAST CONVERTIBLE FANS

Doctor M. F. Egan, American minister at Copenhagen, reports that petroleum is now on the free list in Denmark.

The Yukon Gold Company

SPECIAL CORRESPONDENCE

On May 4, in the Dominion Parliament, Hon. Frank Oliver, minister of the Interior, replied to a series of questions put by Claude Macdonell, of Toronto, respecting the representations made by T. W. Lawson in placing the shares of the Yukon Gold Company on the market. The company, Mr. Oliver said, holds placer-mining claims in the Yukon, situated on Bonanza, Eldorado, Bear and Hunker creeks, but as no record of production by creeks has been kept, the Government is not in a position to corroborate the statement that these claims have a production record of approximately $100,000,000. As to the extent of the company's holdings, the minister stated that many of the claims had not been surveyed, and that as they vary in size, according to the regulations under which they were acquired, the total area could not be computed. The title to the claims was conditional, as work to the value of $200 must be performed on each claim each year, and a renewal fee of $15 paid. The total number of claims acquired by the Yukon company appeared to be 820. The Government had not sufficient information to state whether it was true, as claimed by the company, that the latter had purchased sufficient creek claims to control the mining situation in that portion of the Territory. The question had been asked whether the so-called Treadgold concession had been granted to the Yukon company, and if this referred to a right at one time granted to Ewing Treadgold and Barwick to acquire certain reverted or abandoned claims, which right was subsequently rescinded; the answer was "No." The Government had no information as to the statements appearing in the Lawson advertisement, and had therefore taken no steps to warn or protect the investing public. They had had no communication with Lawson or any member of the Guggenheim syndicate with reference to the acquisition of the claims. In reply to the question whether the Government was aware that the Yukon company was capitalized at $17,500,000, and that the public had subscribed for shares on the faith of statements as to the absolute ownership by the company of the claims, the answer was: "As the company appears to be operating under local ordinance, no doubt a statement as to the amount of capitalization has been filed with the territorial government. This Government, however, has no information.

There is a noticeable discrepancy between Hon. Mr. Oliver's statement as to the extent of the holdings of the Yukon Gold Company and the information furnished in the report[1] of H. H. Rowatt on conditions in the Yukon territory to the Department of the Interior. While the minister gives the number of claims acquired by the Yukon company at 820, Mr. Rowatt's report, dated Sept. 30, 1907, though only recently issued, contains on page 1 the following statement: "The principal gold-producing streams of this district include the Bonanza, Eldorado, Hunker and Bear creeks and their tributaries, and on these streams the above company (Yukon Gold) has already acquired about 950 claims."

In a method for the extraction of zinc (patent applied for under Patents act, 1901, .Germany, Nov. 3, 1905), finely divided zinc sulphide ores are mixed with finely divided iron and heated in an electric furnace. The zinc distils off and may be condensed in the usual condensers or in recesses in the furnace walls. The ferrous sulphide produced is run off from time to time, and the iron is recovered for further use by first roasting to produce oxide, the sulphurous acid produced being collected or converted into sulphuric acid. The iron oxide is then roasted in suitable retorts or kilns with a reducing agent, such as carbon or a hydrocarbon vapor, carbon monoxide, etc., air being excluded. The spongy iron thus produced is used to reduce more zinc ore.

[1]An abstract of this report was published in this JOURNAL, May 16, p. 1019.

Dr. Hermann Wedding

By Joseph Struthers

The death of Dr. Hermann Wedding, on May 7, 1908, brings the sense of great loss in the field of iron and steel metallurgy in Germany; and while this loss will naturally be felt most keenly in his native land, his writings have been so extensively published in English that they have become familiar and useful to a great many American readers.

Hermann Wedding was born in Berlin, March 9, 1834, and in his youth attended the classical gymnasium, from which he was graduated in 1853. For the two succeeding years he served as apprentice in some of the government works in Upper Silesia and then attended the university at Berlin, receiving in 1858 the doctor's degree; he subsequently studied at the Saxon Mining Academy at Freiberg. In 1860 he passed, at Breslau, the first examination required for entry into the government service. In 1862 he was appointed German commissioner to collect and arrange the minerals and metallurgical products for the International Exhibition at London, and his industry in connection with this work contributed largely to its success. In 1865, Dr. Wedding passed the second government examination, that of bergassessor, and was appointed instructor in metallurgy at the Bergakademie of Berlin. His subsequent successive promotions to the positions of professor, mining councilor and privy councilor, were universally recognized as well-earned by his enthusiasm, industry and intelligence as teacher and author. This recognition was expressed in many decorative orders, conferred upon him by the sovereigns of Prussia, Sweden, Russia, Austria, etc., and by numerous medals, given by technical societies, and even more highly valued by him. Among these was the Bessemer gold medal of the Iron and Steel Institute, and the gold medal of the German Association for the Promotion of Technical Industry. He was elected an honorary member of the American Institute of Mining Engineers in 1885, and of the Iron and Steel Institute in 1896.

Doctor Wedding was a generous contributor to the literature of the metallurgy of iron and steel, his most noted books being the "Ausführliches Handbuch der Eisenhüttenkunde," begun in 1864 as a German revised edition of the English treatise of his friend John Percy, and later continued as his own work, and now in its fifth edition; and his monograph on the basic bessemer or Thomas process, which may be regarded as a part of his more comprehensive treatise. The same may be said of some of the many monographs published by him in the German language. The list of his articles and papers is a long one, and we regret that there is not space to publish it here. Few men have contributed as largely to technical literature, and few have approached Doctor Wedding in cleverness and accuracy.

Shaft Troubles at Neu Stassfurt

By Robert Grimshaw*

The protective wall which was erected at great cost to prevent a flow of alkaline water into the main shaft in Neu Stassfurt, Germany, seems to be unable to fulfil its purpose. Insofar as an immediate breaking through of the waters is concerned, there seems to be no present danger. The waters are merely trickling through steadily, especially through the fissures in the anhydrite. Attempts have been made to stop these fissures, but no success has been reported; the water percolates in slowly increasing quantities. On the other side of this protective wall—which cost about $250,000, and was finished in 1905 after two and a half years' steady work—attempts have been made to bore through the anhydrite and by this means to stop the fissures; but the lack of success attending these attempts leads to the supposition that the alkaline water has suddenly taken another path, the course of which is not yet known to the management. The danger to the shaft comes from the Heydt-Achenbach shafts, owned by the Government, and situated in Stassfurt proper. The shafts are still full of water. The amount of water which ran in from this united shaft system was about 500 liters per minute before the protective wall was built. The wall seemed at first to be able to cope with the difficulty, and the management reported a complete and satisfactory solution of the problem; but in the report for the last quarter of 1906 made no reference to it. The pumps can keep the water down at present, and enable the shaft to be sunk to the rich deposits which lie below. All that can be done is to drive down as fast and as far as possible. The work of destruction goes on slowly, and the saturated condition of the water that comes through retards the dissolving process. One good thing is that a new reserve shaft at Rothenförde has been ready for work for some time. This shaft is 6 km. northwest of the present main shaft, and in the neighborhood of the Prussian "Brefeld" shaft.

An earlier boring of the same company (No. 5) found rock salt and potash salt at depths of 155.3 and 160.3 m., respectively. This boring is at a distance of 4.8 km. from Tarthun. All other borings showed only rock salt.

Fuller's earth finds its principal use in clarifying oils and fats.

*Engineer, Dresden-A, Germany.

Iron and Steel in Germany

The consumption of pig iron in Germany is estimated by the German Iron and Steel Union as below, imports and exports of finished iron and steel being reduced to terms of pig iron by proper allowances. The figures are in metric tons:

	1906.	1907.	Changes.
Pig iron produced	12,478,067	13,045,760	I. 567,693
Imported as pig iron	497,240	607,729	I. 110,489
Finished material reduced to pig iron	384,100	459,060	I. 74,960
Total supplies	13,359,407	14,112,549	I. 753,142
Exported as pig iron	613,527	385,766	D. 227,761
Fin. material reduced to pig iron	4,467,041	3,529,940	D. 937,101
Total exports	5,080,568	3,915,706	D. 1,164,862
Consumption	8,278,839	10,196,843	I. 1,918,004

The production of pig iron increased from 203.43 kg. per inhabitant in 1906 to 209.87 kg. in 1907; while the estimated consumption increased from 134.96 kg. per head in 1906 to 164.05 kg. last year.

The production of steel in Germany is reported by the German Iron and Steel Union as follows, in metric tons:

	Acid.	Basic.	Total.
Converter	387,120	7,212,454	7,599,574
Open-hearth	212,620	4,039,940	4,252,560
Castings	85,421	126,077	211,498
Total	685,161	11,378,471	12,063,632
Total, 1906	715,952	10,591,855	11,307,807

This shows a decrease of 30,791 tons in acid steel, and an increase of 786,616 tons in basic; the total gain being 755,825 tons, or 6.7 per cent. The proportion of basic steel to the total made was 93.7 per cent. in 1906 and 94.3 in 1907. The ratio of steel to pig-iron production was 90.6 in 1906, and 92.5 last year.

Six works made acid-converter steel in 1907, while 22 made basic-converter metal. There were 80 works making open-hearth steel, 16 using the acid process, and 64 the basic process.

Mining and Metallurgical Society of America

At a meeting of the council of this Society at New York, May 18, the following officers were elected: President, Prof. H. S. Munroe, New York; vice-presidents, Waldemar Lindgren, Washington, and C. R. Claghorn, Tacoma; treasurer, W. R. Ingalls, New York; secretary, J. R. Finlay, New York; assistant secretary, E. K. Judd, New York; executive committee, H. S. Munroe, W. R. Ingalls, J. R. Finlay, R. H. Richards and F. Lynwood Garrison. The resignation of H. B. Patton, Golden, Colo., as member of the council was received, and E. E. Chase, of Denver, was elected in his place. Steps will be taken immediately to organize local sections of the society and a monthly bulletin of proceedings will be published.

Tailing or Tailings

By R. W. Raymond

A correspondent inquires of me whether he should use the word "tailings" to connote the well known product of ore-dressing, etc., heretofore generally familiar under that name, or shall substitute the form "tailing," which as he is informed, has been authoritatively pronounced preferable.

My reply is, that there is no question of preference between these two forms. "Tailings" is correct as well as current, being justified by sound analogy and by universal usage. "Tailing" is an unwarranted and highly objectionable innovation. Such collective plural forms as "tailings," "headings," "shavings," "cuttings," "clippings," "siftings," "screenings," "drippings," "whittlings," "leavings," and a hundred more, are well established and reasonable, and similar forms are found in the German and other languages. In English, the singular forms of such words have almost always a different meaning as participial nouns. Thus shaving, sifting, etc., are acts, of which shavings, siftings, etc., are the collective results. As to "tailings," the term is used in grain-mills as well as stamp-mills; the word "tailing" has another technical meaning of its own already, and the proposal to alter this general and satisfactory usage has nothing to recommend it, not even the consistency of pedantry. The same may be said as to "heading." But I see no objection to the frequently abbreviated forms, "heads" and "tails."

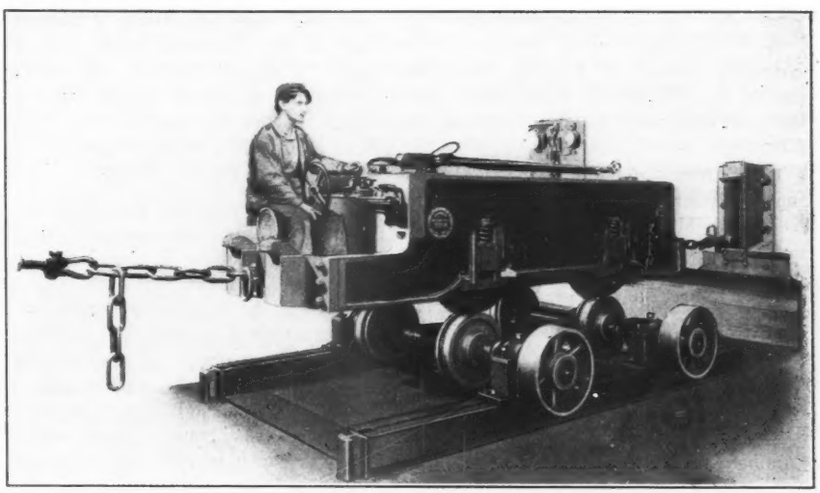
With regard to the substitution of singular for plural forms in such cases as "sands," "slimes," "ores," etc., the argument is not so strong; yet there are, in my judgment, good reasons for preferring the old-fashioned plural, as applied to classes of products which are, or may be further sub-divided. There is a conceivable difference between "sand" and "sands," or "slime" and slimes." Each term might be used in cases where the other would be less appropriate or less definite. It is always a pity to obliterate such distinctions, when they have become well known and have proved themselves useful in practice.

In a United States patent granted to H. Fleck and W. G. Haldane, of Golden, and E. L. White, of Denver, Colo., for the extraction of uranium and vanadium, the following essential features are set forth: The ores are treated with sulphuric acid, the acid solution produced being neutralized by contact with fresh ore. In this way the ore is enriched and may be subjected to fresh contact with an acid solvent. Before recovering the metals from the solutions, sulphur dioxide may be passed in and the metallic compounds reduced with the formation of sulphuric acid.

Electric Locomotive Testing Plant

In order to determine the actual performance of Baldwin-Westinghouse mine and industrial locomotives under service conditions before they leave the works, the Baldwin Locomotive Works has erected a testing plant similar to the locomotive-testing plant which was used at the St. Louis exposition.

The apparatus, shown in the accompanying illustration, consists of a pair of adjustable rolls upon which are placed wheels which may be moved to accommodate locomotives built for any gage. Provision for varying wheel base is made by a movement of the rolls toward or away from each other. The locomotive to be tested is anchored in position by chains attached to the ends. Suitable Prony brakes are used to measure the power developed by the motors, and a switchboard, provided with the necessary electrical instruments, enables a complete record to be made of the performance of every locomotive.



TESTING WESTINGHOUSE ELECTRIC LOCOMOTIVES

Allouez Mining Company

The report of the Allouez Mining Company for the year ending Dec. 31, 1907, states that the proceeds of the year's product paid all the working costs and showed a mining profit on No. 1 shaft of $106,374; deducting the cost at shaft No. 2, a net mining profit is shown of $21,528. The payment for construction and equipment at the mine and the purchase of one-half interest in the stamp-mill property called for the use of the cash balance and also required the borrowing of $185,000; this resulted in a deficit on Jan. 1, 1908, of $38,557, which was largely due to the falling off last year in the recovery of refined copper per ton of rock treated, and increased cost of labor over 1906.

In 1907 the sales of copper were 2,934,116 lb. at an average price of 18.9916c. per lb.; this realized $557,236, which added to the balance on Jan. 1, 1907, gave total receipts for the year of $834,893. The disbursements were: Working expenses at No. 1 shaft, $401,975; smelting, freight, and marketing copper, $48,887; construction at No. 2 shaft, $84,847; construction and equipment at mine, $87,742; total, $623,450. To this is added $200,000 for the purchase of one-half of the stamp-mill property (50,000 shares) and the assessment on 50,000 shares amounting in all to $250,000, making a total disbursement of $873,450, and leaving a deficit of $38,557.

The mining expense comprised 271 ft. of sinking at $20.17; 3343 ft. of drifting at $7.63; 20,941¼ fathoms of stoping at $5.98; 147 ft. of crosscutting at $11.32; total expense, $166,816. The salaries and labor charges brought the total mining expense to $311,525, from which was deducted profit on supplies and other fees of $46,691, making a net mining expense of $264,833. The expenses at the rock house amounted to $12,990; for transportation, $35,769; stamping, labor and assaying, $65,191; surface and incidental expenses, $23,192. Expenses at shaft No. 2 were $84,847.

During the year 227,481 tons of rock were hoisted, from which 12,761 tons were discarded. The 214,720 tons of rock which were treated produced 4,616,180 lb. of mineral, from which was obtained 2,934,116 lb. of refined copper, or 63.561 per cent. of copper in the mineral and 0.683 per cent. of refined copper in the rock. This is a slight falling off as compared with 1906, although the lower levels at No. 1 shaft show a slight improvement.

Because of the sensitiveness of frozen dynamite, boxes of the explosive should never be roughly opened with a pick or hatchet; a wooden wedge and mallet should be used.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. H. Rice, of Houghton, Mich., has been elected president of the Superior & Boston Mining Company, of Arizona, succeeding James Chynoweth resigned.

Francis J. Peck, mining engineer of the firm of Francis J. Peck & Co., Cleveland, Ohio, is examining a mining property in southern Mexico for Cleveland capitalists.

Clarence Woods has resigned his position as engineer for the Trade Dollar Consolidated Mining Company, of Dewey, Idaho, and is at Rolla, Mo., for the present.

W. H. Linney, formerly manager of the Nipissing mines at Cobalt, Ont., has opened an office in the Hyde block, Spokane, Wash., as consulting mining engineer.

T. R. Drummond has been installed as superintendent of the Cactus mine of the Newhouse Mines and Smelters Corporation, in Beaver county, Utah, succeeding A. D. Moffat, resigned.

A. B. Crichton, Johnstown, Penn., has gone to the Tug River district of West Virginia to report on 5000 acres of coal land in that vicinity. Wheeling and Pittsburg capitalists are interested.

Alexander Agassiz, president of the Calumet & Hecla Company, has been making a visit of inspection to the company's property in Michigan. He was accompanied by Quincy A. Shaw, of Boston.

J. E. Spurr and G. H. Garrey, of the firm of Spurr & Cox, Inc., are making a geological survey of the property of the Inde Gold Mining Company, at Inde, Durango, Mexico, with a view to planning the development work for the mine.

Thomas Weir and Henry Catrow, of Salt Lake, and A. J. Catrow, of Miamisburg, Ohio, owners of the large minority interests in the Ohio Copper mine, in Bingham, Utah, are in New York to confer with the majority interests in working out a plan to finance the enterprise.

J. E. Carpenter, manager and secretary of the Swarthmore Gold Mining Company, of Eldora, Colo., has been making a visit to Columbus, Ohio, and while there delivered an address to the mining students of Ohio State University on "The Practical Side of the Mining Engineer's Education."

W. D. Waltman, for the past three years superintendent of the Department of Mining, and assistant superintendent of construction on the Culebra division of the Panama canal, has been promoted to the position of superintendent of construction of the Porto Bello crusher plant, which is to furnish all crushed stone necessary for the concrete work for the construction of the Gatun locks. His address is Porto Bello, via Cristobal, Canal Zone.

Obituary

Samuel Moore Willock, who died in Pittsburg, May 1, aged 66 years, was born at Mifflin, Penn., and had been engaged in the production and refining of petroleum for over 40 years. He owned the Waverly oil works and was interested in other enterprises. He served for several years as vice-president of the National Petroleum Association.

Capt. Samuel Mitchell, of Negaunee, Mich., died in Chicago May 9. He was one of the best known mining men in the Northwest. Captain Mitchell discovered the Negaunee mine, and afterward owned the Jackson, the oldest iron mine on Lake Superior, selling it three years ago to the Clevelend Cliffs Iron Company. Captain Mitchell also developed a number of mines on the Menominee range, in the Norway district. He was born in England, 62 years ago, and leaves a widow and grown-up family.

Arthur Koppel, who died May 13, was born in Dresden, Germany, in 1851, and started in business at the early age of 17 years. He was first interested in a concern in the handling of structural iron and established his own firm in 1876, taking up the problem of transporting all kinds of material by narrow-gage railroads. He made the idea of portable industrial tracks popular and now this concern, which in 1905 was made a stock company, owns 52 branch houses, all over the world; eight plants, of which three are in Europe, one in France, one in Austria, one in Russia, one in Spain and one in the United States. The American business was established 10 years ago, and in 1906 Mr. Koppel came to the United States and decided to build a modern American plant. He, therefore, purchased 700 acres of property in Beaver county, 30 miles west of Pittsburg, Penn., where he founded the town of Koppel and erected the most modern plant in this line, in the United States. With his family, 6000 men in the different plants and concerns and 1500 commercial men and engineers, mourn the loss of a man, who always had the welfare of his employees at heart. His death will cause no change in the concern. One of the managers of the New York office is his son, Kurt Koppel, who is at the present time on his way to Germany.

Societies and Technical Schools

Colorado School of Mines—The thirty-fourth annual commencement was held in Simon Guggenheim hall at Golden, Colo., May 22.

American Society of Mechanical Engineers—The semi-annual meeting will be held in Detroit, Michigan, June 23-26. An entire session will be devoted to papers on the conveying of materials; hoisting and conveying machinery including belt conveyers, the use of conveying machinery in cement plants, etc., will be discussed. The usual receptions will be held and excursions will be made to manufacturing plants and various points of interest in and around Detroit. The Gas Power section of the society will hold a session, and the Society for the Promotion of Engineering Education and the Society of Automobile Engineers will hold meetings in Detroit at the same time.

Engineering Society of Columbia University—Dr. Schuyler Skaats Wheeler, past president of the American Institute of Electrical Engineers and president of the Crocker-Wheeler Company, on May 4 addressed the society on the subject of "Engineering Honor." He alluded to the ethical codes of the various learned professions. He spoke also of the code which he proposed in his presidential address before the American Institute of Electrical Engineers. He mentioned the three great duties of the engineer in the order of their importance, first the engineer's duty to his client, second to the public, and third to his engineering society. He condemned strongly the publication of false scientific and false engineering statements in the newspapers and he declared that discoveries and inventions should be announced, not in the daily papers, but through the technical societies or the technical press.

Construction News

Grass Valley, California—The Union mine is to have 30 stamps added to its present mill. C. J. Graham, Grass Valley, Cal., is superintendent.

Chitwood, Missouri—A mill is to be erected at the Beacon Hill mine. Burt W. Lyon, A. J. Smith and F. W. Kelsey, of Joplin, Mo., are lessees of the mine.

Coaldale, Pennsylvania—Ground was recently broken at Coaldale, Penn., for the erection of the biggest breaker in the Panther Creek valley. It will be built by the Lehigh Coal and Navigation Company and will have a daily output of 4000 tons. W. A. Lathrop is president of the company, the main office being at 108 South Fourth street, Philadelphia. The company has other large improvements in hand.

Austin, Nevada—The Manhattan Consolidated Mining Company is repairing the Clifton tunnel at the mine, and expects to open it up shortly. The company is in the market for several drills and other machinery; also for some machinery for the repair of the mill. The president of the company is C. F. Miesse, Fisher building, 277 Dearborn street, Chicago. C. F. Littrell, Austin, Nev., is superintendent.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Goldfield, Denver, Salt Lake City, San Francisco and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 15—The feature of the week in mining affairs is the record of numerous important and rich strikes in Nevada county. It is noteworthy that the greatest of the recent gold strikes has occurred in one of the oldest quartz mines in Grass Valley—the Idaho-Maryland. At the end of the 1500-ft. drift on the 500 level, a large body of phenomenally rich ore has been met. The strike is the most important made in the district in many years. The vein is about 5 ft. wide—an exceptional width for the district. The actual solid quartz is about 18 in., and it is in this that the heavy gold is found. It is not supposed to be the old Eureka-Idaho-Maryland vein proper, but an entirely new one, parallel with the old one and having all its characteristics. Manager Bray Wilkins has begun sinking a winze from the 500 level to the 600 on the orebody, and will start a crew at work clearing out the old 700 level, which will connect with the 500 and act as a receiver for the ore, which will be hoisted thence to the surface. It is the intention to re-timber the main shaft to the 1000 level and then drift to catch the ledge, which has just set the camp in a state of excitement. The ore so far taken out runs up into high figures in value. The strike was made in virgin ground, and it is expected there will be large ore reserves of high-grade quartz.

In the same county, near Washington, 16 miles north of Nevada City, exceedingly rich ore has this week been struck in the Red Ledge property. The strike is in new ground near the surface. Hundreds of prospectors are going to the locality where there are miles of open Government land. In the Mooney Flat district also, the property of the Marysville Tunnel and Gold Quartz Company is showing up a new find of rich free-gold ore. The Siberia mine at Badger Hill has come into a rich body of gold ore in the lower levels. The ore carries considerable tellurium. The Gold Mound mine at Deadman's Flat, has cut out the old Cook shoot which yielded largely years ago, and excellent milling ore has been found. At the Jennie Lind mine extremely rich gravel has been met in the upraise from the tunnel, and many handsome nuggets are being taken out. The gravel is cemented and must be milled. The find is considered an important one. Deposits of lead and gold ore have recently been found on the Mason ranch, and are about to be exploited.

In addition to these recent finds in Nevada county, it is noteworthy that in the most productive gold-quartz mine in the State—the North Star at Grass Valley—within the last few months numerous ore reserves have been developed below the 4000-ft. level. From a point about 100 ft. below that level the shaft has been carried on an incline to an approximate depth of 5400 ft. The shaft is still going down. Large bodies of ore have been opened up as sinking progressed, much of the quartz carrying excellent values. At the 4400 level, where the ledge is as flat as a floor for a considerable distance, an immense station has been cut. From this point it will be possible to conduct extensive operations in the workings immediately below. The present deepest level is at the 4700 point, but other levels will be cut at an early date. Drifting on the ledge is going on at several points with excellent results. Large reserves of high-grade ore have been developed on several of the lower levels, with continued explorations constantly bringing new reserves within the productive zone. Increasing depth demonstrates that the veins are gaining in value, at the same time maintaining their original size. The ore coming from the lower levels far exceeds that extracted from the upper workings in commercial value.

The O'Hara mine at Brown's Flat, near Sonora, Tuolumne county, which recently yielded $100,000 or more in a few days, is showing up another deposit of "candle-box" ore, from which $15,000 was taken in a few hours. It is probably this lode which enriched the placers of Portuguese gulch which yielded so largely in the early fifties. The croppings are found in Woods creek, which traverses the gulch. The Blue Bell claim, adjoining the O'Hara, is also yielding "candle-box" ore.

W. W. Waggoner, who was at one time State débris commissioner, has found a large vein of copper ore in the watershed of the Bear river, in Yuba county. While the grade of the ore is not high, the vein is a wide one.

The J. B. Chase Company, of Greenview, Siskiyou county, is cleaning out the 10 miles of ditch from Cañon creek and Kelsey, and will dig 12 miles of new ditch. The water is to be conveyed for use on the gravels in the ancient river beds in the Klamath river.

The reopening of the Big Cañon property near Shingle Springs in El Dorado county, will be carried on by Cleveland, Ohio, and Pittsburg, Penn., people. The mine—formerly owned by the late Alvinza Hayward and Chas. D. Lane, of the Utica Mining Company—was considered a low-grade proposition, but with modern methods should pay well. A 60-stamp mill is to be erected, upon a plan which will admit of adding 60 more as soon as the mine can be opened up sufficiently to supply 120 stamps with ore. Work has already begun in earnest in the opening up of the property and within 60 days machinery for the mill will be arriving.

By the time that the pay-shoot in the ledge of the famous Idaho mine, Grass Valley, Nevada county, entered the ground of the Maryland mine adjoining, the cost of handling the ore had become excessive. It had to be handled three times before it reached the mill. The old shaft from which the ore was mined was at all sorts of inclines and very crooked. The new company, which now owns this mine as well as the Maryland, is about to retimber the old shaft to the 1000-ft. level and then sink a 1000-ft. vertical shaft, so as to get at the ore in the old lower workings which could not be profitably mined under the conditions existing formerly. Meantime in the Idaho-Maryland, as the mine is now known, they have found a rich pay-shoot which is maintaining a good average width, and on the ore from this 20 stamps are now dropping. The Idaho was for a long series of years the banner dividend-paying mine of California, and it was not until the chimney ran into the Maryland ground that active operations upon it ceased. The Maryland people would not sell their property at any price deemed reasonable by Coleman Brothers, principal owners of the Idaho, so the latter mine closed down and was finally sold to the Maryland. From the point on the surface where the chimney was struck in the Eureka, until it reached the Idaho ground at 500 ft. depth, and then continued on through that mine to the Maryland boundary line, $16,500,000 in gold was taken out. This is an authentic record, obtained from one of the principal owners, and no mere estimate. It is interesting to note, in this connection, that the Idaho mine was located under the act of July 10, 1866, and could not have been legally located under the present mining law of May 10, 1872, because no ore was found until a depth of 500 ft. was reached, when the ledge, pitching from Eureka ground, was discovered. As, under present laws, "valuable mineral" must be shown, no valid

location could have been made under the circumstances.

Goldfield, Nev.

May 13—An important case was ended in Esmeralda county by the court this week. When the merger of the bonanza mines of the district into the Goldfield Consolidated Mines Company was made, Chas. H. Botsford received a commission of 100,000 shares of Consolidated stock, par value $10, for delivering the Goldfield Combination Mines Company to the merger. Joseph H. Hutchinson, who was lieutenant-governor of Idaho during the Coeur d'Alene trouble, and L. C. Van Kiper, of New York, claimed that Botsford agreed to divide his commission with them for their part in bringing the contracting parties together. They brought suit against Botsford in December, 1906, to receive two-thirds of his shares of stock. The trial passed through many different stages. It was discovered that all of Botsford's stock was in a Los Angeles trust company, and the plaintiff having filed an indemnity bond of $145,000, an injunction was granted prohibiting the bank from delivering the stock. The court found for the plaintiffs, and they are awarded 15,000 shares each, which at this week's high quotation of $6 means $90,000 for Hutchinson and for Van Riper.

The Weber suit developed two points of interest this week. When Weber's case was called neither he nor his attorneys were present, and the court ordered his bond forfeited. This amounted to $60,000 for the six counts. Later on his attorneys succeeded in convincing the court his non-appearance was due wholly to an inadvertence on their part, and the order forfeiting the bond was rescinded. Weber has also filed two counter-suits and threatens to make it interesting for the people who precipitated his trouble. One suit is against Captain Hooper to recover 100,000 shares of Doctor mining stock which Weber claims Hooper obtained by mistake. The other suit is against the Vulture Mining Company, of Wonder, to secure money advanced to it for development work. The Vulture was the first shipping proposition in Wonder, and Weber had so much faith in it that he advanced money from his own pocket it is claimed, and it has never been refunded.

F. M. Smith, of "20 Mule Team Borax" fame, and better known as "Borax Smith," has purchased the Bullfrog & Goldfield railroad from the Brock interests of Philadelphia. Smith owns the Tonopah & Tidewater road, which connects his borax fields in southern California with the Santa Fé railroad at Ludlow. Last fall this road was extended to Gold Center, just outside of Bullfrog, where it connected with the Bullfrog & Goldfield. Owing to lack of harmony between the two roads, freight over the Tidewater road to Goldfield and Tonopah did not receive satisfactory handling, often being delayed several days, although the Tidewater road has the shortest schedule between Los Angeles and Goldfield.

Next week the Nevada railroad commission will meet to discuss rates to the various camps of the State. This interests Goldfield very particularly in two points. It is not possible now to have anything shipped into Goldfield except it is rated *via* Los Angeles or Sacramento. Four years of kick and protest have as yet failed to remedy this. The tariff on Goldfield ores also needs revision. The greatest grievance is against the charges of the Tonopah & Goldfield railroad from Goldfield to Mina, 100 miles, where it connects with the Southern Pacific system.

The Consolidated claims high-grade ores for which it has been suing Pray & Langdon, who ran an assay office in Goldfield. It is claimed thieving miners sold stolen high-grade to the defendants who were arrested at Hazen, with the ore which they were taking to outside points. Their first trial was nullified because it was held in Churchill county instead of Esmeralda. This is only one of many high-grade cases which the Consolidated has on its calendar.

Salt Lake City

May 15—The Tintic Smelting Company's plant is being rushed to completion and the initial unit of the lead department should be ready in about two weeks. Up to the present $185,000 has been expended on construction and $300,000 will have been spent when the lead and copper furnaces are ready for commission.

The lead smelter of the American Smelting & Refining Company at Murray, Utah, is still being operated on a light tonnage, only three out of eight furnaces being in commission. Outside of the May Day, Eureka Hill and Bullion Beck in Tintic and the Utah mine at Fish Springs, very little lead ore is being shipped from Utah mining camps to Murray. At the Garfield copper smelter three blast furnaces are being operated and it is expected that the fourth will be ready in June.

Ten out of the 12 sections of the Utah Copper Company's concentrator at Garfield are complete and shipments are being made from the mine in Bingham on the basis of 100 carloads daily, amounting to 5000 dry tons. The remaining sections of the mill will be in service before the end of June. The Boston Consolidated concentrator at Garfield has been running lately with three sections in operation; the fourth will be started during the week, when the plant will treat 2000 tons per day.

The effort of the Tintic Smelting Company, to obtain common-point freight rates for the several Tintic camps has so far proved fruitless; the Rio Grande Western having refused to consider the proposition further than its report that the concession would not be granted.

Reports on the results of recent development at Pioche, Nev., have been of a gratifying character, and in nearly every instance the finds have been made in territory outside of the old developed zone, where many noted mines were operated in the early days of the camp, showing the mineralized area to be much larger than had been supposed.

Denver

May 16—The grahamite mines at the head of Willow creek, in Grand county, and 26 miles from Granby, on the Moffat road, have been in litigation for five years, and, therefore, unproductive; now, however, the cloud on the title has been cleared, and the property purchased by the Arkon Carbon Company, of Chicago. There are about 1000 tons already exposed by the workings, and 150 tons are now extracted, and will be shipped to Chicago for manufacture into waterproof varnishes and heat-resisting paints. The vein (like gilsonite veins of Uintah county, Utah, on the projected line of the same railroad) is a vertical fissure in sandstone formation, and the grahamite is 4 ft. average width of vein.

Prospecting and mining in the section designated in the Government reports as the Hahns Peak goldfield is increasing daily, and some very good strikes and discoveries are being made. This energy is mainly due to the fact that the Moffat road will be completed to Steamboat Springs within the year. The same energy and enterprise is also evident at the Lay and Craig placers, in Routt county, where several dredges will shortly be put in commission.

The temporary terminus of the Denver, Northwestern & Pacific Railway (Moffat road) has been advanced from Yarmony to McCoy, in Routt county, 157 miles from Denver.

It is reported that the Laramie, Hahns Peak & Pacific Railroad, which starts from Laramie, on the Union Pacific, and is projected toward Craig, in Routt county, has let a contract for 60 miles of grading, which will take it to Walden, in North Park.

Comparisons of the shipments from the Leadville district show an increase of about 10 per cent. for the whole camp for the month of April over March, the tonnage for April being nearly 65,000.

J. J. O'Hara, of Denver, doing business under the name of "The Modern Investment and Securities Company," was convicted of using the mails to promote fraudulent mining schemes, and sentenced to one day's imprisonment and to pay $500 fine and the costs of the case, which latter, it is said, will be in the neighborhood of $10,000. The light

sentence is said to have resulted from the fact that the accused pleaded guilty, and it was in accordance with the request of the prosecuting attorney.

The Federal grand jury has returned about 60 indictments, the majority of cases being in connection with illegal inclosure of Government land by fences, and securing land from the Government by fraudulent methods. Many prominent names appear in the list of those indicted.

Toronto

May 15—Joseph J. Hall, a jeweler of Cobalt, Ont., was arrested in Toronto on May 12, charged with receiving stolen silver ore at Cobalt. The Mine Owners' Association at Cobalt ascertained that a quantity of stolen ore was being shipped to Toronto in a trunk, and communicated with the Toronto police. When Hall arrived from Cobalt he was arrested and his trunk was searched; it was found to contain 175 lb. of high-grade ore valued at more than $1000. The ore is supposed to have come from the Kerr Lake mine. Hall was remanded and will probably be returned to Cobalt for trial there.

With the opening of navigation a great rush into the Montreal river district is anticipated, since many parties have been equipping to do prospecting or assessment and development work upon claims already taken up. Many of these locations are owned by syndicates having their headquarters in New York, Philadelphia and other American cities. There are continued reports of important discoveries in James township. At Elk Lake, in excavating a cellar at the Grand View hotel, H. Mullin, the proprietor, struck a rich vein of silver ore at a depth of 3 ft.; a large silver nugget was extracted. On the Ellis and O'Keefe locations, in the same neighborhood, an 11-in. vein of bornite was struck containing rich silver ore. A big discovery is also reported on the line between James and Tudhope townships, comprising a rich vein bearing native silver; the wall rock for 18 in. on each side shows native and leaf silver. The new camp at Silver lake, situated in the northeastern corner of Mickle township, adjoining James township, is attracting much attention and many finds are reported.

London

May 2—The reconstruction of an unsuccessful mining company is, as a rule, carried through according to the terms arranged by the directors, and it is seldom that the dissentient shareholders are strong enough or think it worth while to challenge the legality of the scheme put forward. The case of Henderson's Transvaal Estates, Ltd., is, however, an exception. A dissentient shareholder brought an action in the courts to restrain the company from selling its assets to a new company for shares carrying a liability. The new company was to issue partly-paid shares to the shareholders in the old company, and in the event of any shareholders refusing to accept such shares, the liquidator was to sell the non-accepted shares for what he could get, and distribute the proceeds among the retiring shareholders. Those who refused to contribute further to the undertaking were, therefore, to be deprived of their share of the assets, and would only get whatever the liquidator might be able to realize for the shares not applied for.

On the first hearing of the case the shareholder lost, but on appealing to a higher court the reconstruction scheme, as described above, was declared *ultra vires*.

In giving judgment the judge described the case as one of the first importance. Under the British companies' act the liability of a shareholder is strictly limited, and provision is made that in case of liquidation, the assets are to be sold and after the creditors have been paid, the proceeds are to be distributed among the shareholders. The reconstruction scheme was held to be a violation of the principle of limited liability, as it practically forced a shareholder to put more money into the concern or to take the compensation that the scheme offered, and which in practice commonly means nothing. The question involved is of importance to shareholders in limited liability companies. Many are not prepared to contribute further, and to have an assessment imposed on them with the alternative of the loss of their interest in the concern is clearly an injustice. When fresh capital is required it ought to be obtained by giving preferential rights as to profits and capital without wiping out previous subscribers. Reconstruction schemes on the lines of Henderson's Transvaal Estates closely resemble the cost-book system of Cornish companies, which is unlimited liability, and which favors in the long run the longest purse.

One of the few known mines on the Gold Coast, the Abbontiakoon Block I, in asking for further capital, gives some information as to the cost of working. For the year ending Dec. 31, 1907, the cost of mining, milling and development based on 63,686 tons milled, was $7.478 per ton of 2000 lb. To this must be added for general expenses on the coast $0.78 and for London, expenses and interest charges $0.56, making a total cost of $8.82 per ton milled.

From the tons milled 28,791 oz. gold were recovered. For the first six months of the year the treatment of the ore was by the dry process, giving an extraction of only 64.6 per cent., while for the last six months the wet process was used giving an extraction of 90.8 per cent. The ore reserves are given as 130,277 tons assaying 7.6 dwt., or 83,336 averaging 9.9 dwt. In view of these figures a considerable reduction in the working costs is wanted, for profits to be earned.

Johannesburg

April 13—The March results from the mines were encouraging as to amount. It is satisfactory to note, also, that the native labor position again improved during March. Native labor has never been more plentiful than at present, and the mines have no difficulty in getting as many Kafirs as they want. At present the supply is greater than the demand. This is a rather extraordinary state of affairs for South Africa, but it is readily understood, and every sane man realizes that conditions are abnormal, and that we will have a scarcity of native labor by-and-by. The acute depression all over South Africa has meant a contraction of public works, railroad construction, etc. The crisis in the diamond market has closed down some small mines, and restricted the output of DeBeers and the Premier mine. At the present moment the DeBeers, Jagersfontein and Premier diamond mines are employing about 20,000 fewer natives than they did at one period last year.

During March the net gain in the unskilled labor position was 4015. The number of Kafirs distributed during the month was 15,245 against 11,230 time-expired Kafirs returning to their homes. Against the gain of 4015 natives must be placed the loss of 1902 Chinese coolies, who were sent back to China during the month, thus leaving a balance to the good of 3113 for March.

A new record is established for the Rand by the Robinson gold mine, as far as working costs are concerned, for during March this mine worked for $3.12 per ton. This is a most encouraging result, and people are expecting to see even better results on this, the premier gold mine of South Africa.

The first mine on the list for December as regards output was the Simmer & Jack, with a yield of 26,429 oz., valued at £112,263; the next was the Robinson, with a yield of 25,483 oz., valued at £108,245, while the third mine on the list was the Robinson Deep, with a yield of 20,949 oz., valued at £88,986. The profit of the Simmer & Jack was £63,844; that of the Robinson was £80,062, and of the Robinson Deep, £42,926—quite a respectable trio.

There are now 70 tube-mills at work on the gold mines of the Transvaal, and they have helped the output very much. At the Luipaard's Vlei Estate mine the duty per stamp per 24 hours is now 9.12 tons, probably the highest duty ever attained in any part of the world.

The amount of waste rock sorted out from the ore varied during March on the different mines. At the Princess Estate they sorted out 35.63 per cent. of waste, while at several of the other mines there was no rock sorted out, everything from the mine being sent through the mill.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY—BISBEE

Copper Queen—For a long time the company has been carrying on work preparing for a radical change in the handling of its ore, and for a more economical and thorough electric equipment of the entire property. At present the ore is hoisted through five different shafts each with its individual steam plant. To avoid this multiplication of plants preparations are being made to hoist all the ore from one centrally located shaft, the Sacramento, and to generate power for the whole property at the one central power plant. The ore is to be drawn to the Sacramento shaft by electric motors, which will operate in drifts used exclusively for long distance haulage. These drifts will connect the central shaft with the other shafts at vertical intervals of 200 ft. Hoists will still be operated at the five old shafts, but used only for handling men, waste and timbers. To replace the steam power now in use electric current will be used at the Czar shaft; at the Holbrook, Spray and Lowell, compressed air, and at the Gardener, steam brought directly from the new power plant. The central hoist at the Sacramento will also be operated by steam generated at the power plant. With the exception of one air compressor the new power plant is practically complete. At the mines the production of ore is slightly under what it was a year ago, but development and improvement keep the full number of men employed. The Lowell shaft, which is the newest of the producing mines, is now being sunk from the 1300-ft. level, and will be carried down about 120 ft. to the Hoatson 1200. It is already 90 ft. below the 1300-ft. level. Near the Shattuck side line, the Uncle Sam, a two-compartment shaft is being sunk at the rate of about 100 ft. a month. It is down 470 ft. with no ore discoveries so far.

Calumet & Arizona—There have been few recent developments except a modification of the general square set system of mining used everywhere else in the camp. This new system has been developed at the Oliver shaft by General Foreman Mitchell. The combined ore production for this property and the Superior & Pittsburg so far this month is nearly 100 tons below the average of last month, running from 1425 to 1450 tons a day.

Superior & Pittsburg—In the Hoatson mine of this company the stoping and development work on the 1200-ft. level has shown up large quantities of both sulphide and oxide ore of good grade. On the 1300 drifting has proceeded about 350 ft. from the station, and although indications are promising, no ore of any amount has yet been discovered.

Warren Realty and Development—The large three-compartment shaft of this company, down a little more than 600 ft., is being sunk at the rate of 40 ft. a month. It is located about two and one-half miles southeast of the Junction, one of the nearest producing mines. The shaft is at present in barren limestone, and the estimated depth at which the ore-bearing lines of the district will be reached is about 2000 feet.

Arkansas

MARION COUNTY

McCray & Veale Land—R. P. Zemplin has purchased this tract of 120 acres near Yellville, and is arranging to develop it.

New York Zinc & Lead Company—A. W. Estes, of the Estes Development Company, has been appointed resident agent for this company and has taken charge of the Bear Hill mine and other properties of the company, near Yellville.

California

CALAVERAS COUNTY

Cowbell—Operations on this mine near Fricot City, owned by C. H. Kucks, of Oakland, Cal., will shortly commence. The vein is to be tapped at 500 ft. depth; air drills and other appliances are to be installed.

EL DORADO COUNTY

Sherman—The new double-compartment shaft at this mine, Placerville, is now down to 650 ft., and a drift will be cut to the ledge. The new 10-stamp mill will soon be ready for crushing. Thomas Clark is superintendent.

Hart Consolidated—L. B. Parker, representating Colorado men, has bonded this property at Garden Valley. A new tunnel to tap the vein lower than the old one will be run, and as soon as developments are sufficient, a mill will be erected.

FRESNO COUNTY

Fresno Magnesite Company—Bechler & Co. have deeded to this company the lands in section 5, township 12, range 24, covering several locations carrying magnesite deposits.

INYO COUNTY

Crackerjack Bonanza—Chas. H. and F. A. Stillwell have purchased large interests in this property and have set a crew at work driving a tunnel to cut the dike, in which high values have been found. Arrangements are being made to put up a stamp mill. Chas. H. Stillwell is general manager.

NEVADA COUNTY

Brunswick--Extensive development work is being done in this Grass Valley mine, by Superintendent Chas. H. Mullen. The work is being mainly done on the 600 and 1200 levels.

Marysville Tunnel and Gold Quartz Company—High-grade free-gold ore has been struck in this property at Mooney Flat. Both gravel and quartz are being worked on these claims, which are owned by Marysville people.

Idaho-Maryland—Rich ore has been found in new ground at the end of the 1500-ft. drift, in the 500 level of this old mine at Grass Valley. Bray Wilkins is general manager.

Gold Mound—The south drift in this mine at Deadman's Flat, Howard Dennis superintendent, has cut the old Cook shoot, which years ago yielded rich ore. At the point cut excellent milling ore has been found.

South Idaho—The owners of this property are about to resume operations. The locations are 100 ft. south of the Idaho shaft.

Golden Gate—This company at Nevada City, W. P. Martin superintendent, has purchased the Alpha mine, owned by Wm. George.

Mountaineer—A large hoisting plant has been put in this mine, in the main tunnel, now in 2000 ft. Thirty men are at work in the mine.

Leduc—A new engine and compressor house is being built, and work has commenced in the tunnel.

Republic—This property, at Graniteville, has lately been taken over by Estes Bradford and Geo. W. Wyman, of New York, and the 10-stamp mill is kept busy.

SAN DIEGO COUNTY

Buckhorn Mining Company—This company at Dulzura, the new gold camp, is about to commence sinking a 500-ft. shaft to prove the continuance of the veins with depth.

Dulzura—At this new camp, in addition to the Buckhorn company, the Consolidated Artery, Jumbo, Catherine C., Los Angeles, Tunnel and Clark owners, are pushing development work to prove the

permanency of the vein. The Eureka, a new group, is also being opened by two shafts.

SHASTA COUNTY

Eastside—From this mine near Coram, owned by J. W. Ames, H. E. Bidford and O. Lowenthal, shipments or ore have commenced.

Uncle Sam—Fred Maxwell, the new lessee of this mine at Kennett, is beginning to ship ore to the Mammoth smelter.

SIERRA COUNTY

Sierra City—At this old camp the Sierra Buttes, Cleveland and Keystone mines are producing ore and crushing it.

SISKIYOU COUNTY

California Consolidated Mining Company—In the Mountain Laurel claim of this company at Rollin, W. H. Young, manager, a rich shoot of ore has been found 80 ft. above the Stevens tunnel level.

Chrome Ore—Chas. E. Everett, of Hamburg, has located two deposits of chrome ore near his home.

Musgrave Copper Group—These copper claims on Horse creek have been purchased by Tebbe Brothers.

TRINITY COUNTY

Union Hill—At this mine, Douglas City, two giants are washing off the surface loam before attacking the gravel.

TUOLUMNE COUNTY

O'Hara—Gold continues to come from this mine at Browns Flat in great quantities, more than $200,000 having been taken out in a few weeks.

Tarantula—This mine at Chinese, adjoining the Eagle-Shawmut, is about to be sold to London and New York men. The mine was discovered in early days, but has been worked only intermittently.

YUBA COUNTY

Labadie—W. J. & J. B. Labadie at Dobbins ranch have found on their property what is considered to be an extension of the Solano Wonder ledge.

Red Cross—Good ore is being taken from this mine near Dobbins owned by Krupp & Queenan.

Eagle—It is expected that Eastern men will shortly reopen this mine at Indian Ranch.

Colorado

BOULDER COUNTY

St. Louis—Denver and Boulder people have taken hold of this property at Caribou, and will unwater it and develop it for regular production. W. L. Tanner, Caribou, Colo., is in charge.

Cash Mill—This mill at Summerville has been leased for the balance of the year by W. F. Cross, who is working the Atlanta property, and will be started up at once to handle the ores from the property of the Five Points company.

Bald Mountain & Evening Star—This property, near Holtville, has been taken over by Denver people, who will incorporate a company and carry on operations, with F. E. Litzenberg as manager.

Pembroke—An air compressor plant and new boiler are being installed on the Gold King mine, at Wolfram Junction. G. W. R. Pettibone is manager.

CLEAR CREEK COUNTY

Alice Development Company—Idaho Springs and other Colorado people have organized this company for the purpose of operating the Alice property, near Yankee Hill. They intend to erect a 20-ton concentrating plant for the purpose of testing the large bodies of low-grade ores. W. L. Shaffer and A. H. Roller, of Idaho Springs, are in charge of operations.

Vidler Tunnel—An order has been entered to sell at public auction the entire holdings of this company in the Argentine district; May 25 is the day of sale, at the office of W. B. Harrison, referee in bankruptcy, Quincy building, Denver, Colorado.

Syndicate—The Cass County Mining Company has taken charge of this mine at Dumont, and C. O. Harmon, Dumont, Colo., is manager. J. Chandler, formerly of the Homestake cyanide mill at Lead, S. D., will have charge of the mill.

GILPIN COUNTY

Evergreen Gold and Copper Mining Company—A contract has been given to the Denver Engineering Works for the construction of a 60-ton concentrator, to be completed inside of 60 days. Rolls will be used for crushing, the Richards process of jigging for the classification of ores, and Card tables will be installed. A Leyner air compressor and drills have been purchased for the mine. Dr. W. H. Grayson, Empire building, Denver, Colo., is president and manager.

Pendleton-Gomer—Denver and Eastern people are interested in the organization of this company to operate the Pendleton and Gomer groups in Russell district. A. A. Johnson, Russell Gulch, Colo., is to be manager.

Frontenac—British people are interested in the purchase of the Frontenac mine and mill site. H. P. Lowe, Equitable building, Denver, Colo., is managing director.

Druid Gold Mining Company—Denver and Scotch capitalists are interested in the purchase of the Searle claim, for a cash consideration of $10,000. It is in Willis gulch. C. M. Anderson, Central City, is manager.

Penobscot—Valley Falls, Kan., people are interested in the starting up of work near Perigo, under management of P. J. Hamble, Rollinsville, Colo. The main tunnel is to be extended several thousand feet into Perigo and Tip Top mountains.

Golden Cloud—Fred Charles, representing New York people, has taken a lease and bond on this property, also the J. L. and Nashville groups in Russell district.

OURAY COUNTY

Black Bird—Two shifts are now working in the tunnel on this property, in the Uncompahgre district, and a new crosscut has been started.

Boulder—The lessees on this property, on Cow creek, Morris, Nichols & Wood, have reached ore in their main crosscut.

Revenue—In this mine, in the Sneffels district, work has been started for the season, 100 men being employed.

Saratoga—Joseph Irving, manager of this mine, has gone East, to buy hoisting and other machinery.

SAN JUAN COUNTY

Shenandoah-Dives—Lessees on this mine at Silverton have been active and are preparing to ship a considerable quantity of ore.

Trilby—The main adit is now in 2000 ft., the face being about 900 ft. below the surface. An orebody of good size was recently found, which is believed to be an extension of the Cuban vein.

TELLER COUNTY—CRIPPLE CREEK

April shipments of ore are reported at 64,023 tons, a gain of 2031 tons over March. The estimated value was $1,345,000, being somewhat lower than in March, owing to the greater proportion of low-grade ore shipped. Total shipments reported for the four months ended April 30 were 240,082 tons of ore.

Henry Adney—The high-grade seam recently found on the 500-ft. level is widening out gradually. It is near the center of a wide streak of low-grade ore.

Porter-Gold King—This property, on Gold hill, has been leased for two years to H. J. Anstey. He has begun operations on the 500-ft. level.

Requa-Savage—The Evelyn Leasing Company, working in this mine, has cut, on the 600-ft. level, the orebody which has been worked in the upper level. It was found a short distance west of the shaft.

Georgia

WHITE COUNTY

Loud Gold Mine—Negotiations are pending for the sale of this old property to H. D. Ingersoll and W. H. McAfee, of Dahlonega. The Loud mine has been a good producer.

Idaho

SHOSHONE COUNTY

Federal—The Last Chance mine of this company at Wardner is to be opened with-

in a few days, and men have already been put to work cleaning up and preparing for the full crew. It is given out by the management that the mine will be run at full capacity at which it employs between 200 and 300 men. All the mines of the company except the Standard and Mammoth have been closed down since the first of the year. The advancing price of lead is given as the cause of the present resumption of operations.

Hecla—This company has recently completed the installation of one of the finest electric hoists in the district, and a crew of men is now being assembled with a view to operating. Although mining has not been in progress here for several months, development work has continued and some large orebodies have been opened up at depth during the winter and late spring.

Lucky Calumet—The crew, which was recently reduced to two shifts, will be increased at once. The heavy snows in the mountains have prevented the hauling in of supplies, but with the opening of spring this will be overcome. Development work is now in progress in the lower levels.

Idora—This mine, situated on Sunset mountain, will be re-opened early in June, and it is the intention of the management to put it on a shipping basis this season. The property comprises five claims and is developed by means of a shaft and adit. Galena of good grade has been struck in the lower levels. No work has been done for about a year, there being adverse claims, but these have been settled.

Gold Hunter—The annual report, recently filed with the county assessor, shows a net loss during 1907 of $75,138.63, as compared with a net loss in the previous year of but $89. This is accounted for by the fact that the mine has been under expensive development during the past winter. The striking of a rich vein of galena in the lower levels was one of the recent development features of the district. The company extracted last year 41,357 tons of ore.

Caledonia—The new electric hoist has been put in commission, and it is said by the management that development work will be carried forward immediately. Work at present is in progress in the sinking of a shaft on the ledge and in drifting, four shifts being engaged.

Custer—Harry L. Day, of the Hercules mine, has taken up the bond on the Custer group, which he has held for two years. This property was formerly a shipper and ore taken from it is estimated at $600,000. It is expected that work will be carried on steadily, but the management has made no definite announcement.

Idaho County

Good Enough—This mine, in the Marshall lake district, has recently changed hands, the control going to S. C. Edger, of St. Louis, Mo., who has bought up all the stock owned by Chester and Tyler Irwin. The property is extensively developed with five adits. A crew is now at work, and this will be increased as soon as the new manager takes charge, which will be early in June.

Kansas

Zinc-lead District

Hartford Mining Company—This company will build a 300-ton mill on its tract, two miles south of Galena. The contract has been let to Wigginton & Milton, of Webb City, Missouri.

Michigan

Copper

Atlantic—In cutting the plat at the 16th level of the shaft at section 16, the vein rock of the Baltic lode was encountered. It has been entered at this point for about 12 ft. and shows good copper. The present showing is the most encouraging since operations began. In sinking this shaft and in the lateral openings of the upper levels, the formation has been very fragmentary with the vein matter showing only intermittently. At the 12th level the breast of the south drift is in a good grade of stamp rock well charged with heavy copper. In sinking the shaft from the 12th to the 16th level, no drifting has been done at the intervening levels, and from the showing both at the 12th and 16th levels it is reasonably sure that, as depth is reached and the lateral openings are extended, the shattered and unsettled condition will have been passed and that the Atlantic will again enter the list of producers. The possibilities of this tract are good, as it carries the underlay of the Baltic lode for about 1¼ miles. The old mine was well equipped with hoisting engines and compressors, which can easily be moved to the site of the new openings. The stamp mill is in good working order and is now handling the rock from the Michigan mine. Railroad connections have been made between the mill and the shaft site.

Copper Range—The crosscut at the sixth level of the Globe shaft has penetrated an amygdaloid lode, carrying a little copper; the identification of this lode has not been reliably established. As this shaft is going down, preparations are being made at each level, so that, as soon as the lode is cut, crosscutting can start simultaneously from the different levels to intercept the lode. The shaft is going down vertically until the lode is encountered when it will bend and follow the formation, which has a pitch of about 70 deg. The shaft had to pass through 228 ft. of overburden before the ledge was struck, and the first level was started 356 ft. from the surface; the succeeding levels are 100 ft. apart. No. 5 shaft of the Baltic is drifting north from the 14th level toward the Atlantic's section 16 property, with gratifying results.

King Phillip—At a depth of 280 ft. from surface the first crosscut to the lode has been started at No. 2 shaft. The lode is believed to be about 90 ft. away. At No. 1 shaft sinking has been resumed below the eighth level and a crosscut from that level is being driven to the lode.

Calumet & Hecla—The foundation has been completed and the parts are being assembled for the new 150-drill air compressor. This is a duplicate of the three now operating, and when put in commission it will give this plant a capacity of about 660 drills; there is also a 60-drill machine installed at the present time. Work on the underground pumping installation is progressing favorably and the pumps and motors will soon be put underground. This plant will take care of all the water from the north end of the mine, and will eliminate water hoisting at the Red Jacket shaft.

Iron

Chapin and Aragon—Orders were received by General Superintendent Davidson to curtail operations at these Steel Corporation mines on the Menominee range. It was decided to divide the force and work men alternate weeks until further notice.

Volunteer—This Marquette range mine has been sold for the heirs of the late Senator Alger to Duluth interests. The mine will be operated by the New Volunteer Ore Company. The property comprises 1900 acres containing a large body of low-grade ore.

Missouri

Zinc-lead District

Beacon Hill Mine—A company composed of Burt W. Lyon, A. J. Smith and Fred W. Kelsey, all of Joplin, has secured for $25,000 a 20-year lease on 20 acres of the Leonard land at Chitwood, The company is to be incorporated for $100,000. The lease includes the old Beacon Hill mine and 10 lots. Three shafts and 17 drill-holes are in ore. A mill is to be erected.

Barnard Mining Company—D. M. Layers has sold his 10/16 interest in this company's lease to J. B. Murphy and J. H. Barnard for $30,000.

Black Diamond—The mill of this company, at Smelter hill, was totally destroyed by fire, entailing a loss of $12,000. A defective flue was the cause. A new mill will be erected.

Bumblebee—This company has filed papers of incorporation for $200,000, to operate the Bumblebee and other properties. F. J. Green, of Enid, Okla., Geo. Roden, of Granby, Mo., R. H. Davis, of Pierce City, and J. W. Brooks, of Joplin, compose the company.

Edgar Zinc Company—This smelter has

adjusted its labor trouble and will resume operations at once.

Porter Mine—Joplin men have secured a lease of the Porter, Myers and Stickney lots and a part of the Chautauqua ground, where the rich strike of mineral was recently made by L. P. Benua, near Carthage.

Turkey Flat—A. M. Wagner and associates, of Webb City, have leased this property and are prospecting with two drills.

Becker—This mine, at Seneca, has entered the list of producers with a turn-in of 152,740 lb. zinc and 36,600 lb. lead for the first shipment.

Hanover—This company has filed papers of incorporation with a capital stock of $100,000. The following Joplin men compose the company: Burt W. Lyon, J. H. Spencer, B. B. Howard, Chas. W. Bartlett, M. J. Lyon and J. A. Wilson. The company has a lease on 36 acres of land south of Carterville, on which is a shaft, and 14 drill-holes are in ore. A 200-ton mill will be erected.

Lone Star—This company owns a tract of valuable mining land 5 miles east of Carthage, which it is preparing to open up on a large scale. Chas. Tobias is president; Lyle Jackson, secretary, and C. W. Eastwood, treasurer. Silicate and jack are found on the land and two shafts are in ore.

Maud L—A rich strike of zinc has been made at the Maud L. mine on the Leonard land at Chitwood, by Mr. Gundling. A mill is to be erected when development is completed.

Mammoth—This company will build a new mill on its lease south of Carterville. Work will begin immediately.

Porter Land—Ralph Corbin, of Joplin, and A. B. Williams, of New Mexico, have secured a lease on the Porter ground at Carthage. Material is being hauled to the lease and work will start at once. A 200-ton mill will be erected and two 12-inch pumps installed.

Montana

BUTTE DISTRICT

Davis-Daly—The shaft on the Colorado is now down 1000 ft. Owing to the faulty nature of the leads, crosscuts have been driven east, west and south from the shaft, and in each of these crosscuts veins have been intersected which carry commercial ore. Drifting is in progress on these veins, but so far the orebodies have been but slightly explored. The west vein is the most promising up to date. Work is progressing steadily on the Hoy shaft, which has reached a depth of 200 ft. From this depth crosscuts have been run to the west and the south and defined veins have been cut. Drifting has been done on one vein, and the vein found to carry approximately 4 ft. of high-grade ore.

La France Copper Company—The zinc mill at the Lexington mine still continues to be the object of considerable attention on the part of Walkerville citizens. At a recent meeting of the city council it was decided that 15 days be given the company in which to abate the dust nuisance caused by the mill; if conditions are not improved, injunction proceedings will then be instituted.

Butte & Superior—The company reports that ore has been struck at a distance of about 90 ft. south of the shaft on the 1000-ft. level. The statement given out by the management shows that the ore runs high in zinc and silver, with small quantities of gold and copper. With the blasting of the first round of holes in the vein, a considerable flow of water was encountered, which will necessitate the suspension of operations for several days, until the flow is diminished. The exact width of the vein has not yet been determined.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—The production for the week ending May 9 was 1715 tons, total value $99,265. Of this the Combination mill received 665 tons; the Western Ore Purchasing Company, 498 tons; from Great Bend, 31 tons; Rogers Syndicate, 101; Florence Consolidated Mining and Leasing, 15; Daisy, 31; and Wingfield lease on Florence, 320 tons. Purchases by the Nevada-Goldfield Reduction Company were: Daisy, 29 tons; Jumbo Dump, 104; Begole Syndicate, 322; Mushett lease, 57; Combination Fraction, 40; total, 552 tons.

Florence Consolidated Mining and Leasing—This company, which operates a lease on the Combination claim of the Florence ground, has made another strike, this time 18 in. of ore running $700 per ton. Two weeks ago a 12-in. strike assaying $900 per ton was found. This high-grade ore comes from the 173-ft. level.

Rogers Syndicate—The rich ore-shoot which was lost temporarily, has been found on the 500-ft. level. The lease has been shipping 45 to 50 tons per day, and this will probably be doubled until the expiration of the lease on July 11 next.

Thomas Lease—This old lease on the Combination No. 3, of the Goldfield Consolidated, recently taken over by C. S. Sprague and others is being put in shape for active development. The shaft is being enlarged and retimbered, and a 30-h.p. electric hoist will be installed.

ESMERALDA COUNTY—RAWHIDE

The dumps of several of the mines are beginning to show ore accumulations, and the camp is taking on an air of permanence. There are now 17 hoists in operation, five more await delivery at Schurz, and 16 others have been ordered.

Bushwhacker—This property southwest of the Tiger, is a new producer. Two shipments netted $72 and $87 per ton, respectively.

Queen Regent—This mine is producing shipping ore. The shaft is down 200 ft., and is equipped with a gasolene hoist.

Copper King—This mine is developing a 3½-ft. ledge carrying copper, gold and silver.

Kearns Lease—Four shipments during March and April varied in value from $80 to $132 per ton.

EUREKA COUNTY

Richmond and Eureka Mining Company—Superintendent A. P. Maybury intends to resume operations about June 1. The master mechanic has been summoned to put the plant in order.

Windfall—Chord & Locke have begun work on their lease under promising conditions. Surface workings develop shipping ore of the same character as that taken out farther south. The ore carries gold and silver and will be shipped to the 10-ton experimental cyanide plant at Eureka.

NYE COUNTY—BULLFROG

Keane Wonder—A new body of ore has been encountered in the Wilson drift. The hoist is being moved to the new shaft, and a pump is being installed in the old shaft to supply water to the mill. A line of pipe 3800 ft. long will convey the water to the reduction plant.

West Extension—The force of men at work on the property will be increased to 30 about June 1.

NYE COUNTY—TONOPAH

Ore Shipments—The ore shipments over the Tonopah & Goldfield Railroad for the week ending May 9, to the Western Ore Purchasing Company, consisted of 130 tons from the Tonopah Extension. The Tonopah Company sent 3250 tons, the Belmont Company 600 tons, the Montana-Tonopah 1100 tons, the Jim Butler 280 tons, the Midway 100 tons, and the MacNamara 100 tons to the mills, making the total shipments for the week 5560 tons of an estimated value of $116,400.

Belmont—A body 6 ft. wide of good milling ore has been encountered on the 700-ft. level. Drifts have been started east and west on the new find and have followed the ledge in both directions, the orebody showing no loss in strength.

Midway—The crosscuts on the lower levels in new ground have passed through the big body of quartz, both faces showing andesite. Drifting east is in progress on the south vein and the face shows 14 to 16 in. of high-grade ore. The regular shipments go to the Belmont mill, the ore now being mostly directly from the mine, the dumps having been practically cleaned up.

Montana-Tonopah—The extraction at the mill for the week ending May 9 was

93⅓ per cent. In the mine a new vein of oxidized ore 3 ft. wide has been found. This is an entirely new body and a winze has been started to develop it. A crosscut is also being run on the 615-ft. level to intersect it below.

Utah

BEAVER COUNTY

Indian Queen Consolidated—The management has recently purchased electric-power equipment at an expense of $6000. The treasury of the corporation contained $15,139 on May 1. The company is developing its property by means of a tunnel.

GARFIELD COUNTY

Utah Antimony—This company, which is composed of Salt Lake and Butte parties, has provided facilities for the treatment of ores on the ground, and according to a statement made by Thompson Campbell, the manager, success has been attained. Last year considerable money was expended in the erection of a concentrating mill and providing power facilities, but difficulty was then experienced in finding a profitable market for the product. A series of tests were then made with volatilization, and, Mr. Thompson declares, the plan has worked out very successfully. Equipment has been provided to treat from 50 to 100 tons of ore per day.

JUAB COUNTY

Ajax—Preparations are being made to resume production from this property in Tintic, which has been idle for several months. The treasury of the corporation contains about $20,000.

Beck Tunnel Consolidated—The new shaft at this mine is down 650 ft., and has been recently equipped with a new hoist. The company has about $6000 debt.

Canada

ONTARIO—COBBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending May 9 were as follows: Buffalo, 46,290 lb.; Foster, 69,800; La Rose, 40,000; McKinley-Darragh, 60,000; Nipissing, 122,240; O'Brien, 127,500; Right of Way, 60,470; total, 526,300 pounds.

Cleveland Cobalt—Work was resumed recently. The crosscut, from the main drift, is being continued in the hope of tapping the large vein at the south end of the lake.

McKinley-Darragh—The present force of 95 men and 5 drills will be increased during the summer. The mine will continue shipping at the rate of two cars of ore per week, one car out of every three shipped being high-grade ore. The ore extracted is all in the course of development, and no stoping is being done.

Right of Way—A winze is being sunk from the first level, at a point 110 ft. south of the north shaft to connect with the drift from the main shaft. At the second or 145-ft. level the drift will be continued to the north shaft and thence onward to explore the northern portion of the property at that level.

ONTARIO—HASTINGS COUNTY

Deloro Smeltery—The smeltery has for some time been running at full capacity on Cobalt ore and recently 51 silver ingots weighing more than 3000 lb. were shipped. About 150 men are now employed.

Pearce—Development work at this gold mine in Marmora township has been in progress for some time, and tests of ore, which recently have been made at the Deloro stamp mill, showed satisfactory results.

ONTARIO—WELLAND COUNTY

British-Canadian Smelters, Ltd.—The town of Chippawa, Ont., has voted $2000 to purchase a site for the plant of this company which will be located on the Niagara river; the company already has 10 acres of ground. A portion of the machinery for a smeltery to treat Cobalt ores is on the ground. The company will employ more than 50 men when the plant is completed.

Mexico

CHIHUAHUA

Strike in Roncesvalles—A strike of rich silver ore in the Bien Venido mine at Boruquillas, in the Roncesvalles district, has aroused great interest in Parral. A shipment of four tons of the ore netted $4000. Denouncements were at once made in the vicinity by many mining men from Parral, about 200 pertenencias being denounced within 10 days.

La Rresa—This old property, lying west of Parral, on the Mexican Central, has been sold to a Philadelphia syndicate. The mine has not been worked for several years, owing to the presence of water. Exploration will begin at once, and if the results are favorable, it is reported that the property will be merged with those of the Esmeralda-Parral Mining Company.

Las Coloradas—This mine in the Inde district is shipping a carload of rich ore per day to the smeltery at Torreon and its lower-grade ores to La Roja plant.

Parcionera—This property, a famous producer in colonial days, and consisting of about 84 pertinencias, is reported sold to a group of New York capitalists.

Plomosas—This property, near Picachos station, on the Kansas City, Mexico & Orient road, near Conchos river, is shipping about 40 carloads of zinc ore monthly to the smelters in the United States. The concentrator is in operation.

San Antonio—Schuyler Lawrence, who is working this property in the Santa Eulalia district under lease from the American Smelting and Refining Company, is shipping a carload of ore per day.

GUANAJUATO

Shipments of bullion out of Guanajuato during the week ending May 11 were about $20,000 less than during the preceding week. The continued low price of silver has compelled several of the mining companies to substitute cheaper assistants for some of the high-salaried employees.

JALISCO

Mexican Mines-Prospects Development Company—This company has acquired a controlling interest in the Compañia Explotadora de Jalisco and the entire administration has been placed in the hands of the management of the company. Some prospecting has been done and a small tonnage of high-grade copper-silver ore has been extracted incidentally, but no attempts at extractng ore will be made until a thorough exploration of the properties has been made. The Mexican Mines-Prospects Development Company has moved its Mexico City offices to the Bancaria building, Cinco de Mayo 32.

MEXICO

Dos Estrellas—During the month of April the two mills worked continuously crushing 31,244 tons of ore; ore shipped amounted to 369 tons; and total production $609,755. Working costs were $334,826, and expenditures for new installation, $57,411.

SAN LUIS POTOSI

Dolores—The American Smelters Securities Company has purchased property and has begun the erection of a 500-kw. electric-power plant at Matehuala with a high-tension transmission line to the Dolores property seven miles distant.

Asia

INDIA—MYSORE

Kolar Goldfield—The gold production in April as 45,607 oz. bullion, being 205 oz. less than in March. For the four months ended April 30 the total was 178,409 oz. bullion in 1907, and 181,476 oz. in 1908; an increase of 3067 oz. The bullion reported this year was equal to $337,590, or 163,328 oz. fine gold.

South America

BRITISH GUIANA

Gold exports for the three months ended March 31 were 17,086 oz. bullion in 1907, and 14,742 oz. in 1908; a decrease of 2344 oz. The bullion reported this year was equal to $258,102, or 12,003 oz. fine gold. Exports of diamonds were 399 carats, valued at $3124, this year.

COLOMBIA

Quibdo Gold Dredging Company—This company has been incorporated with $1,500,000 capital stock, for the purpose of operating gold dredges on the Negua river, near Quibdo, Colombia. The officers are John A. Drake, president; J. B. Elwell, vice-president; Arthur R. Manice, treasurer. The main office is at 66 Broadway, New York.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 20—Coal trade in the West is rather slow and quiet. Trouble is threatened in Indiana, where miners and operators differ over the clause in the contract imposing fines for striking before a dispute is submitted to arbitration. Neither side is disposed to yield. Elsewhere mining is going on, but not very actively. The demand for steam coal is light, and the Lake trade has not fairly opened. Many mines are running only one-half or one-third time.

In the East the bituminous trade is dull. The steam-coal demand is light, and even where contracts have been made, the deliveries are called for slowly. The trade does not seem to improve to any great extent. The mines, in many cases, are running on part time.

Anthracite trade makes the best showing, and production keeps up fairly well. The shipments are large, and seem to be absorbed without difficulty.

Coke trade this year so far has fallen off over 50 per cent., and is improving very slowly.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 9, in short tons:

	1907.	1908.	Changes.
Anthracite.....	1,981,516	1,927,189	D. 54,327
Bituminous.....	13,462,972	11,415,858	D. 2,047,114
Coke.....	5,072,586	2,447,380	D. 2,625,206
Total.....	20,517,074	15,790,427	D. 4,726,647

The total decrease this year to date has been 23 per cent.

Coastwise shipments from Atlantic ports, three months ended March 31, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York....	3,416,925	2,481,169	5,898,094	63.4
Philadelphia	454,054	1,136,278	1,590,332	17.1
Baltimore....	38,172	919,460	957,632	10.3
Newp't News	.....	590,177	590,177	6.4
Norfolk.....	.....	259,322	259,322	2.8
Total.....	3,909,151	5,386,406	9,295,557	100.0
Total, 1907.	4,315,111	5,357,269	9,672,380	.....

Total decrease this year, 376,823 tons, or 3.9 per cent.

Coal receipts at Boston, reported by Chamber of Commerce, four months ended April 30, long tons:

	1907.	1908.	Changes.
Anthracite.....	662,197	540,180	D. 122,017
Bituminous.....	913,119	1,038,936	I. 125,817
Total domestic....	1,575,316	1,579,116	I. 3,800
Foreign.....	185,055	175,450	D. 9,605
Total.....	1,760,371	1,754,566	D. 5,805

The foreign coal is chiefly from Nova Scotia, with a little from Great Britain.

Coal receipts at St. Louis, three months ended March 31, were 1,994,458 short tons in 1907 and 2,251,497 in 1908; increase, 257,039 tons.

New York

Anthracite

May 20—The market is sluggish for both prepared and small steam sizes. It is expected that prepared sizes will pick up just before the usual advance on June 1. The small steam sizes are in good supply and pea coal, which was inclined to be short, is now plentiful. Prices are as follows: Broken, $4.35; egg, stove and chestnut, $4.60; pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.65@2; barley, $1.35@1.50; all f.o.b. New York harbor.

Bituminous

It can hardly be said that there is any improvement in the soft-coal trade, although a few dealers seem to think that business is slightly better. In the far East, and along the Sound business is very poor and there seems to be no disposition to take on stocks. Whatever trade there is seems to be among those people who are obliged to take on coal before a certain time, dependent largely upon shipping and transportation facilities. New York harbor is without interest and good grades of steam coal fetch $2.50 per ton. Stocks in the harbor are a trifle larger than last week.

Transportation from mines to tide is not rapid, cars taking a little more than a week to run through. The supply of cars is greater than the demand. In the Coastwise vessel trade large vessels show an inclination to tie up rather than to accept business at prevailing rates. The idea seems to be to force a shortage of coal and thus create demand and high prices for carriage. Freight rates are as follows: From Philadelphia to Boston and Salem, 55@60c.; to Portland, 60c.; to Lynn and Portsmouth, 70c.; Newburyport, 75c.; Saco $1; Bath, 65@70c.; Gardiner, 80c.; Bangor, 70@75c.; to the Sound, 50@55c.; towages where usual.

Birmingham

May 18—The coal trade in Alabama is dull. The production is off about 40 per cent. Several of the commercial coal producers report conditions poor. There is no trouble in getting all the cars necessary. Consumers are offering almost any price for coal and in many instances their offers are being accepted. Coal prices in Alabama have not been down as low as they are at present in many years. The larger consumers are out of the market almost altogether.

Coke is dull and prices low. The prospects with the coke makers are not good at present.

Chicago

May 18—The coal market, with the resumption of normal conditions of mining in the West, is almost featureless. Demand for steam coals increases slowly, with supplies of all kinds plentiful. Eastern coals are weak, and fine sizes no longer command a premium. Domestic coals continue fairly good sellers owing to cool weather, anthracite being in better demand than the lake supply warrants.

Lump coal has a light sale at $1.75@2 for Illinois and Indiana, run-of-mine from these States bringing $1.60@1.80, and screenings $1.40@1.60.

Hocking at $3.15 and smokeless at $3@3.15 are in mild demand, but have no over-supply. Youghiogheny is a light seller at $3.20 for ¾-inch, though much coal is moving on contracts. In general contract-making is improving, but many large consumers prefer to take chances in the open market.

Pittsburg

May 19—The railroad coal mines in the Pittsburg district are running to more than 75 per cent. of capacity. The Pittsburg-Buffalo Company is operating all of its mines to capacity and is increasing its facilities. There is no shortage of cars and the Pittsburg Coal Company is filling nearly all it can handle with coal for Lake ports. The docks at Cleveland are crowded with coal and the railroad sidings are rapidly being filled. The Lake vessels are to start for the Northwest during the coming week, as the ore movement is to begin on June 1, when the congested docks will be relieved. Nearly all the river coal has been sent out and large tows of empty coal boats and barges have been returned. The mines will be kept running steadily until all are loaded. Current coal trade conditions are not good, but operators are holding the price on a basis of $1.15 at mine on all contracts and for early delivery are asking $1.20. It is believed that this price is being shaded in some instances by independent producers but the large interests refuse to cut.

Connellsville Coke—The improvement in the coke trade is slight. The H. C.

Frick Coke Company has started more ovens and expects to put about 500 more on the active list the coming week. Prices remain about the same. Furnace coke, prompt shipment, is $1.55@1.60 and on contract $1.70@1.80. Foundry coke is $2 @2.25, both spot and on contract. The *Courier* in its report for the week gives the production in both regions at 173,045 tons. The shipments aggregated 5867 cars, distributed as follows: To Pittsburg, 2335 cars; to points west of Connellsville, 3200 cars; to points east of Connellsville, 332 cars.

Foreign Coal Trade

Imports and exports of fuel in Germany, three months ended March 31, metric tons:

Imports:	1907.	1908.	Changes.
Coal	2,375,856	2,351,949	D. 23,907
Brown coal	2,013,953	2,201,737	I. 187,784
Total coal	4,389,809	4,553,686	I. 163,877
Coke	105,258	130,790	I. 25,532
Briquets	37,663	48,816	I. 11,153
Exports:			
Coal	4,724,804	4,929,200	I. 204,396
Brown coal	3,982	6,068	I. 2,086
Total coal	4,728,786	4,935,268	I. 206,482
Coke	863,042	926,791	I. 63,749
Briquets	286,009	332,211	I. 46,202

Coke exports this year included 1042 tons to the United States. Imports of peat fuel this year were 3404 tons; exports, 4214 tons.

Coal bunkered, or sold to steamships in foreign trade at United States ports, three months ended March 31, was 1,426,117 tons in 1907, and 1,453,578 in 1908; an increase of 27,461 tons. Adding exports, previously reported, makes the total coal sold for consumption outside of the United States for the three months, 3,680,233 tons in 1907, and 3,723,037 tons in 1908; an increase of 42,804 tons.

Iron Trade Review

New York, May 20—The market for pig iron shows a little more activity. Foundries are taking advantage of low prices to some extent. Buyers insist upon the reductions, however, and are not yet disposed to order much ahead. Southern iron still takes most of the business.

The only activity in finished material is in structural steel. Some bridge and building contracts are being placed, but generally at low prices. How they will work out remains to be seen, but contractors evidently expect to get reductions on material.

Generally speaking, the trade is standing still. The action of the next meeting of steelmakers is awaited with much interest. Buyers evidently will do little or nothing on the present nominal scale of prices, unless they can find independent mills ready to make concessions.

Lake Superior Iron Ore—The winter movement of Lake iron ore was as follows, in long tons, according to the statistics collected by the *Marine Review*, of Cleveland, Ohio:

	1907.	1908.	Changes.
Stocks on docks, Dec. 1	6,252,455	7,385,728	I. 1,133,273
Stocks on docks, May 1	1,976,988	5,480,300	I. 3,503,312
Winter shipments to furnaces	4,275,467	1,905,428	D. 2,370,039

Adding these winter shipments to 29,787,018 tons, the amount shipped to furnaces during the navigation season of 1907, gives 31,692,446 tons as the entire shipment of ore from Lake Erie ports during the year ended May 1, 1908. The stocks on docks May 1 last were the largest ever reported at the opening of navigation.

Baltimore

May 19—Included in exports for the week were 4000 tons rails to Cuba; 933 tons steel billets and 248,082 lb. galvanized sheets to Liverpool; 1,532,778 lb. tin scrap to Rotterdam.

Birmingham

May 18—A better inquiry for pig iron in the South is noted. Prices are not as strong as they were a short time since, in fact some sales are reported to have been made at $11.50 per ton, No. 2 foundry. Some of the producers of iron who have been maintaining strong prices are yet announcing the $12 rate.

A report is out that the resumption of operation at the big steel plant of the Tennessee company will take place June 5 instead of June 15, as was recently stated. It is learned that some good orders for steel were received recently. There has been a readjustment of wages at the steel plant.

Foundries and machine-shop proprietors continue to report room for improvement in general conditions with them.

Chicago

May 18—The last week has shown no change in the pig market. Southern iron is said to be selling at $11 Birmingham—$15.35 Chicago—on favored lots of No. 2 foundry, but $11.50 represents the admitted price at which much of the business is being done. Melters are talking persistently of $10 Birmingham, but furnace agents insist that this price will not be made. Inquiries are numerous and for increasing amounts, which seems to show consumers' readiness to buy as soon as they feel that the bottom price has been reached.

Northern iron holds firm at $17 for No. 2 foundry, with light shading for desirable contracts and sales for small amounts to be delivered 30 to 90 days from date of sale. Lake Superior charcoal is featureless at about $20.

Coke is somewhat more active at $4.90 for the best Connellsville.

Philadelphia

May 20—More inquiries and some buying have characterized the local pig-iron market. There is no pronounced tendency, however, and it is impossible to quote prices, as every sale has its own terms, which the parties are not willing to disclose.

Steel Billets—Quotations nominally unchanged. It is evident that buyers will do nothing as long as there is a prospect of lower prices.

Bars—Store trade is a little better, but no large business is reported.

Plates—Not much to report. The question of prices is uppermost, and no heavy business can be done until that is settled.

Structural Material—Some contracts are pending, but there is delay in closing them.

Old Material—The movement is a little more free, especially for heavy steel and railroad wrought. Cast scrap is slow.

Pittsburg

May 19—There is no material change in the steel market this week, but more inquiries are being received for pig iron. Orders for finished steel products continue to come in, but for small tonnages. The Carnegie Steel Company is still operating its structural mills at the Homestead plant to capacity, but its plate mills are on slow time. Some foreign business is being figured on and there is a probability that the Japanese government may come into this market for 75,000 or 100,000 tons. A party of 15 Japanese, who are visiting this country, came to Pittsburg yesterday and were shown through the Carnegie steel plants by S. A. Benner, general manager of sales, and W. R. Balsinger. Operations were resumed yesterday at the Bessemer steel plant of the Republic Iron and Steel Company. This plant has been running about every other week for several months.

There is considerable talk about reductions in prices of crude steel and finished products, but all are positively denied by the large interests. One of the reports was that the National Tube Company would reduce prices $6 a ton, June 1. This rumor probably started through the fact that in taking contracts during the past four or five months the company guaranteed the price until May 31. At the office of the company today it was stated emphatically that no reduction in prices is contemplated at this time. Meetings of steel men are to be held during the week, at which the subject of prices will be considered. The general impression is that there will be no radical change, if any, in quotations. It is believed that one or two interests are weakening and contemplate cuts on steel bars and other finished products.

Pig Iron—The pig-iron market is more active as to inquiries. It is probable that most of them are genuine and will result

in contracts. Consumers appear to realize that the bottom has been practically reached. The inquiries for bessemer and basic iron received within the past few days aggregate 50,000 tons. There also is a good demand for foundry iron and prices remain firm on the basis of quotations made last week, as follows: Bessemer, $16; No. 2 foundry, $14.50; basic and malleable bessemer, $15; gray forge, $14, all f.o.b. Valley furnaces. There are reports here of low prices for Southern iron, some quotations being $11, Birmingham, for No. 2 foundry. It is known that some small tonnages for prompt shipment have gone at the $11 price.

Steel—Both bessemer and open-hearth billets are still quoted at $28, Pittsburg, the freight being divided. Merchant steel bars are weak at 1.60c. and plates are still quoted at 1.70c.

Sheets—Market fairly active and prices firm. Black sheets, 2.50c.; galvanized, 3.55c. for No. 28 gage.

Ferro-Manganese—There has been a stiff advance in prices and the market is quite active. A number of inquiries have been received and the minimum quotation was $46.50, an increase of $1 a ton.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, May. 20.

At all U. S. Ports in April and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Apr. 1908..	$14,476,341	$ 2,417,170	Exp. $12,059,171
" 1907..	2,219,844	4,974,527	Imp. 2,754,683
Year 1908..	18,335,344	19,846,243	" 1,510,899
" 1907..	7,923,148	16,621,142	" 8,697,994
Silver:			
Apr. 1908..	4,452,564	3,308,106	Exp. 1,144,458
" 1907..	4,862,998	3,970,443	" 892,455
Year 1908..	17,038,851	14,138,762	" 2,900,089
" 1907..	19,532,394	15,355,969	" 4,176,425

Exports from the port of New York, week ended May 16: Gold, $7,297,134, chiefly to Paris; silver, $519,196, chiefly to London. Imports: Gold: $635,423, from France and South America; silver, $115,095, from Central America and Mexico.

Specie holdings of the leading banks of the world May 16 are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$313,980,500
England.....	$185,146,345	.....	185,146,345
France.....	588,224,245	$182,010,740	770,234,985
Germany.....	171,060,000	70,890,000	241,950,000
Spain.....	77,800,000	131,470,000	209,270,000
Netherlands....	38,489,000	21,478,500	59,967,500
Belgium.....	20,933,335	10,466,665	31,400,000
Italy.....	181,770,000	22,050,000	203,820,000
Russia.....	562,700,000	35,920,000	598,620,000
Aust.-Hungary.	232,965,000	67,445,000	300,410,000
Sweden.....	19,355,000	.....	19,355,000
Norway.....	7,755,000	.....	7,755,000
Switzerland....	16,915,000	.....	16,915,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Foreign trade of the United States, four months ended April 30, valued by Bureau of Statistics, Department of Commerce and Industry:

Merchandise:	1907.	1908.
Exports.....	$ 667,951,174	$ 648,930,232
Imports.....	512,256,862	346,345,030
Excess, exports.....	$ 155,694,312	$ 302,585,202
Add excess of exports, silver.....		2,900,089
Total.....		$ 305,485,291
Deduct excess of imports, gold.....		1,510,899
Total export balance.....		$ 303,974,392

Silver Market

SILVER AND STERLING EXCHANGE.

May.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	May.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
14	4.8715	52⅝	24¼	18	4.8715	52⅞	24⅜
15	4.8715	52½	24⅛	19	4.8715	52⅞	24⅜
16	4.8715	52⅝	24¼	20	4.8715	53⅛	24½

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to May 7:

	1907.	1908.	Changes.
India... ...	£4,610,334	£2,865,558	D. £1,744,776
China.....	.....	511,400	I. 511,400
Straits.....	321,500	90,200	D. 231,300
Total.....	£4,931,834	£3,467,158	D. £1,464,676

Imports for the week were £190,000 from New York, £22,000 from the West Indies and £4000 from China; £216,000 in all. Exports were £322,965, to India.

Copper, Tin, Lead and Zinc

May.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
—	12⅜	12½			4.22½	4.60	4.45
14	@12⅞	@12¾	58	29½	@4.27½	@4.65	@4.50
	12¾	12½			4.22½	4.57½	4.42
15	@13	@12¾	57⅞	30	@4.27½	@4.62½	@4.47½
	12¾	12½			4.22½	4.57½	4.42½
16	@13	@12¾	.....	30¼	@4.27½	@4.60	@4.45
	12⅞	12⅝			4.22½	4.57½	4.42½
18	@13	@12⅞	58⅛	30⅛	@4.27½	@4.60	@4.45
	12⅞	12⅝			4.22½	4.57½	4.42½
19	@13	@12⅞	59	30½	@4 27½	@4.60	@4.45
	12⅞	12⅝			4.22½	4.57½	4.42½
20	@13	@12⅞	57¾	30	@4.27½	@4 60	@4.45

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—As a consequence of the sustained advance in the stock market, an active speculation was started in the London standard market the early part of the week, which necessarily had a direct effect upon the price of refined sorts. Business for export was resumed on a larger scale, but domestic consumers have not been tempted to enter the market in any materially larger way than for some weeks past, although there appears to be a steady, but very slow, improvement in the demand from them. This is reflected in the increase in the transactions in Lake copper, of which some rather large sales were made in the early part of the last calendar week at low prices, and on the advance were made at decidedly higher figures by producers who had previously been holding aloof. However, at the end of the week May 14-20 the flurry in London appears to have exhausted itself and the market has a tired and uncertain appearance. Quotations at the close are 12⅞@13c. for Lake copper; 12⅝@12⅞c. for electrolytic in ingots, cakes and wirebars. Casting has advanced along with the other classes, the average of the week being 12⅜@12⅝c.

Speculative buying started an upward movement in the standard market, which at one time put the quotation for both options above £59. Heavy realizing brought about a decline at the close to £57 15s. for spot, £58 10s. for three months.

Statistics for the first half of the current month show an increase in the visible supplies of 1500 tons.

Refined and manufactured sorts we quote: English tough, £61@62; best selected, £61@62; strong sheets, £73@74.

Manufactured Copper—Sheets, cold-rolled, 18c.; hot-rolled, 17c. Wire, 14¾c. base.

Tin—At the beginning of this week this metal had one of its occasional spurts which advanced it about £4 from the low, to £137 for spot, £135 10s. for three months. However, the close is weak at £135 10s. for spot, £134 for three months.

Home consumers who have become rather suspicious of these sporadic advances in the London market did not respond. In consequence, business has been small. Prices for spot metal, however, are well sustained as the available supplies are closely held. The market at the close is quoted about 30c. per lb. for spot.

Lead—Business is quiet and the market closes unchanged at 4.22½@4.27½c. New York.

The London market has shown a little more life and advanced during the week 7s. 6d., the close being cabled at £13 5s. for Spanish lead, £13 7s. 6d. for English lead.

Spelter—The continued absence of demand for more than retail lots has made some of the smelters impatient and they have pressed their metal for sale, with the result that quotations have declined further to 4.57½@4.60c. New York, 4.42½@4.45c. St. Louis.

A slight recovery occurred in the London market, the close being cabled at £19 5s. for good ordinaries, £19 10s. for specials.

Zinc Sheets—Base price is 7c. f.o.b. Lasalle-Peru, less 8 per cent.

Other Metals

Antimony—The market, both in New York and abroad, is dull. Quotations are 8¾@9c. for Cookson's; 8⅝@8¾c. for Hallett's and 8⅛@8⅜ for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base.

Cadmium—In 100-lb. lots, $1.25 per lb., Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45@50c., New York.

Quicksilver—New York, $45 per flask. San Francisco, large lots nominal at $44.50, domestic, and $43, export; small orders, $45@46. London, £8 5s.

Platinum—Extreme dullness in the platinum market caused a further reduction of 50c. per ounce. Quotations now are: $25 for hard platinum, $22.50 for ordinary, and $17 for scrap.

Imports and Exports of Metals

Exports and imports of metals in the United States for the three months ended March 31 are reported as follows, in the measures usual in the trade:

	Exports.	Imports.	Balance.
Copper, long tons	81,364	20,241	Exp. 61,123
Copper, 1907	40,480	31,161	Exp. 9,319
Tin, long tons	64	7,385	Imp. 7,321
Tin, 1907	97	11,386	Imp. 11,289
Lead, short tons	20,297	27,946	Imp. 7,649
Lead, 1907	5,299	19,490	Imp. 14,191
Spelter, sh. tons	453	256	Exp. 197
Spelter, 1907	218	216	Exp. 2
Nickel, lb	3,545,298	3,545,591	Imp. 293
Nickel, 1907	2,872,832	4,487,585	Imp. 1,614,753
Antimony, lb	.....	1,923,190	Imp. 1,923,190
Antimony, 1907	.....	2,924,058	Imp. 2,924,058
Platinum, lb	.....	757	Imp. 757
Platinum, 1907	.....	2,536	Imp. 2,536
Quicksilver, lb	42,687	.....	Exp. 42,687
Quicksilver, '07	159,536	.....	Exp. 159,536
Aluminum, value	$109,890	.....	Exp. $109,890
Aluminum, 1907	84,283	.....	Exp. 84,283

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. Zinc ores exported were 6071 tons in 1907, and 6067 tons in 1908; zinc dross, 6,517,683 lb. in 1907, and 7,264,612 lb. in 1908. Zinc ores imported this year, 4022 tons calamine and 4393 other ores, 8415 tons in all; not reported last year. Antimony ores imported, 757,597 lb. in 1907, and 284,003 lb. in 1908. Exports given above include re-exports of foreign material.

Missouri Ore Market

Joplin, Mo., May 16—The highest price paid for zinc was $39 per ton, unchanged from the previous week, the assay base dropping to a range from $33 to $36 per ton of 60 per cent. zinc, all grades averaging $34.20, an increase, owing to the small amount of silicate shipped. The highest price paid for lead was $57, 50c. higher than last week, medium grades bringing $51@55, and all grades averaging $53.80 per ton.

Shipments of both minerals were larger, and conditions have materially improved during the week, as several days have passed without rain. Nearly all mines resumed operations toward the close of this week or will be in operation early next week.

Following are the shipments of zinc and lead from the various camps of the district for the week ending May 16:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,048,450	860,880	$77,020
Joplin	2,394,060	182,630	46,916
Galena	840,900	137,690	18,183
Duenweg	673,680	117,820	15,027
Prosperity	377,550	181,200	11,577
Alba-Neck	413,050	.....	7,434
Oronogo	405,640	.....	6,972
Badger	355,030	20,850	6,608
Aurora	277,240	7,950	4,789
Quapaw-Baxter	135,330	92,940	4,771
Granby	320,000	10,000	4,575
Carthage	195,140	.....	3,512
Sarcoxie	145,040	.....	2,465
Spurgeon	151,350	7,780	1,927
Stott City	31,340	.....	533
Reeds	37,410	.....	299
Peoria	33,830	.....	169
Totals	9,835,040	1,619,740	$212,777
20 weeks	182,933,250	26,574,290	$3,835,807
Zinc value, the week, $168,196; 20 weeks,			$3,163,297
Lead value, the week, 44,581; 20 weeks,			672,510

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	34.92	February	84.58	49.72
March	48.66	34.19	March	82.75	49.90
April	48.24	34.08	April	79.76	52.47
May	45.98	.....	May	79.56	.....
June	44.82	.....	June	73.66	.....
July	45.79	.....	July	58.18	.....
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	58.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Wisconsin Ore Market

Platteville, Wis., May 16—One choice car of roasted zinc ore brought $38.50 per ton this week; the next highest price being $37.50, paid on a basis of $36.50 per ton of 60 per cent. zinc. Lead ore sold the same as last week, $53 per ton of 80 per cent. lead.

Finding it unprofitable to mine at current prices a few zinc producers have again closed down. Encouraged by the better prices offered for lead ore, the Wilkinson and Wiseman, exclusive lead producers in the Benton camp, have resumed operations again after a shut-down lasting all winter long.

Shipments, week ended May 16:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	627,265	69,000	.....
Hazel Green	390,000	124,700	.....
Galena	271,200	.....	.....
Benton	204,980	132,480	.....
Highland	142,000	.....	.....
Livingston	130,000	.....	.....
Harker	126,640	.....	.....
Linden	92,880	.....	.....
Days Siding	88,000	.....	.....
Mineral Point	65,720	.....	.....
Elmo	64,870	.....	.....
Cuba City	62,500	72,900	.....
Total	2,266,055	399,080	.....
Year to May 16	27,574,495	2,628,025	79,800

In addition to the above there was shipped to the electrostatic separator at Platteville, from Linden, 42,900; from Benton 78,500; from Strawbridge 40,000; from Rewey 40,000; from Hazel Green 83,000 lb. of zinc concentrates.

Chemicals

New York, May 20—Consumers have not departed from their policy of buying only for immediate needs, and the market remains dormant. Spot goods are generally low, with few inquiries for future delivery.

Copper Sulphate—Standard goods remain unchanged at $4.65 per 100 lb. for carloads and $4.90 for smaller quantities. We hear of outside dealers offering spot sulphate at $4.50 for good grades.

Nitrate of Soda—The market is quiet, but prices are firm and unchanged. Quotations are 2.32½c. for spot and 2.30 for other positions of 1908. Deliveries in 1909 fetch 2.30c. and for 1910 prices are nominally 2.32½c. Spot 96-per cent. grade sells for 2.37½ cents.

Sulphur—Messrs. Emil Fog & Sons, Messina, report shipments and stocks of Sicilian sulphur for the two months ended Feb. 29, as follows, in long tons:

	1907.	1908.	Changes.
United States	76	1,774	I. 1,698
Other countries	54,469	69,268	I. 14,799
Total Exports	54,545	71,042	I. 16,497
Stocks, March 1	533,921	572,778	I. 38,857

The Consorzio has advanced prices 1 lira per 1000 kg., and another advance is expected.

Mining Stocks

New York, May 20—A generally strong market through the week was followed today by sharp breaks in leading stocks, among which Amalgamated Copper was prominent. The reaction was not altogether unexpected by inside operators, apparently, but it caught many speculators unprepared.

The curb market was active most of the week, especially for the copper stocks. It closed on the reaction rather confused and irregular, with a downward tendency evident.

The money market was generally easy and favorable to speculators. The renewal of gold exports on a large scale had no apparent effect.

Boston

May 19—Sentiment continues to improve, which is clearly reflected in the mining share list. Copper stocks have been near the boiling point several times during the week and the market has broadened materially. Since the low point of last October, 31 of the leading stock companies have recovered an aggregate of over $200,000,000 in their market value.

Atlantic mining has been a prominent feature, having fluctuated from $15 to $19.25, with the final $18 tonight. Mining

on the Baltic lode at this property will now be pursued. Copper Range has also been a feature, advancing $3.37½ to $74.50, with set back to $73 today. A general reaction followed today, which puts the market in a better condition. North Butte spurted $5 to $66.25, reacting to $63.37½. Butte Coalition went above $25, Boston Consolidated to $14.50, Allouez to $30.50.

The annual report of the U. S. Smelting, Refining and Mining Company showed net earnings of $2,070,213 for 1907, while $2,768,580 was distributed in dividends.

East Butte has been the curb feature, selling up $2.25 to $7.25 on favorable reports from the property.

STOCK QUOTATIONS

NEW YORK	May 19
Name of Comp.	Clg.
Alaska Mine	⅛
Amalgamated	67¼
Anaconda	43½
Balaklala	1
British Col. Cop.	5
Butte & London	¼
Butte Coalition	24½
Colonial Silver	⅛
Cum. Ely Mining	8½
Davis Daly	3¼
Dominion Cop	1½
Douglas Copper	5
El Rayo	1⅞
Florence	3¾
Foster Cobalt	.65
Furnace Creek	.15
Giroux	3½
Gold Hill	1/16
Goldfield Con	5¾
Granby	‡90¼
Greene Gold	1/8
Greene G. & S	⅛
Greenw'r & D.Val.	.75
Guanajuato	2⅛
Gnggen. Exp.	160
Hanapah	‡.20
McKinley Dar	13/16
Micmac	3¾
Mines Co. of Am.	1⅝
Mitchell Mining	⅛
Mont. Sho.C	1/32
Nev. Utah M. & S	3⅞
Newhouse M. & S.	7¾
Nipissing Mines	7
Old Hundred	¾
Silver Queen	1.20
Stewart	1/16
Tennessee Cop'r.	37⅞
Tir-Bullion	1/16
Union Copper New	⅛
Utah Apex	4¼
Utah Copper	31¾
Yukon Gold	4⅛

N. Y. INDUSTRIAL	
Am. Agri. Chem.	20⅜
Am. Smelt. & Ref.	73¼
Am. Sm. & Ref., pf.	99⅛
Bethlehem Steel	15¾
Colo. Fuel & Iron	28⅛
Federal M. & S.,pf.	76
Inter. Salt	17½
National Lead	62¾
National Lead, pf.	100¾
Pittsburg Coal	13¼
Republic I. & S.	18½
Republic I.& S.,pf.	69¼
Sloss-Sheffield	50¼
Standard Oil	613
U. S. Red. & Ref.	‡13¼
U. S. Steel	38½
U. S. Steel, pf	102½
Va. Car. Chem	24½
Va. I. Coal & Coke	‡56

ST. LOUIS	May 16	
N. of Com.	High.	Low.
Adams	.30	.20
Am. Nettie	.04	.03
Center Cr'k	2.25	1.50
Cent. C. & C.	68.00	66.00
C.C. & C. pd.	76.00	75.00
Cent. Oil	110.00	95.00
Columbia	4.00	2.50
Con. Coal	19.00	15.00
Doe Run	125.00	110.00
Gra. Bimet.	.20	.15
St. Joe	15.00	12.50

BOSTON	May 19
Name of Comp.	Clg.
Adventure	2
Allouez	29½
Am. Zinc	27⅝
Arcadian	4
Arizona Com	19¼
Atlantic	18
Bingham	.95
Boston Con	13⅛
Calumet & Ariz*	111¾
Calumet & Hecla	691
Centennial	25
Con. Mercur	.40
Copper Range	73
Daly-West	11
Franklin	9
Greene—Can.	9¾
Isle Royal	21
La Salle	15¾
Mass	3⅜
Michigan	10⅛
Mohawk	54
Nevada	12¼
North Butte	64
Old Colony	.50
Old Dominion	35¾
Osceola	93
Parrot	22
Quincy	87
Rhode Island	3½
Santa Fe	2¼
Shannon	13⅜
Superior	18
Tamarack	62
Trinity	14
United Cop., com.	8¼
U. S. Oil	23½
U. S. Smg. & Ref.	39
U.S.Sm. & Re.,pd.	42¾
Utah Con	42
Victoria	5
Winona	6
Wolverine	136
Wyandotte	.60

*Ex. Div. †Ex. Rights. ‡Last quotation.

BOSTON CURB	
Ahmeek	73
Black Mt.	4¼
East Butte	7
Hancock Con	‡3⅞
Keweenaw	6
Majestic	.68
Raven	1⅜
Shawmut	.40
Superior & Pitts	13⅛
Troy Man	.50

LONDON	May 20		
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	1	6
Camp Bird	0	12	6
Esperanza	1	6	3
Tomboy	1	10	6
El Oro	1	3	9
Oroville	0	11	6
Somera			
Utah Apex			
Ariz. Cop.,pfd.			
Ariz. Cop.,def.			

Cabled through Wm. P. Bonbright & Co., N.Y.

NEVADA STOCKS.

May 20.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.18
Belcher	.22	St. Ives	.31
Best & Belcher	.49	Triangle	.05
Caledonia	.10	BULLFROG STOCKS	
Challar	.07	Bullfrog Mining	.04
Comstock	.40	Bullfrog Nat. B.	.06
Con. Cal. & Va	.32	Gibraltar	.05
Crown Point	.25	Gold Bar	.05½
Exchequer	.21	Homestake King.	.30
Gould & Curry	.10	Montgomery Mt.	.06
Hale & Norcross	.31	Mont. Shoshone C.	.81½
Mexican	1.10	Original Bullfrog.	.01
Ophir	2.60	Tramp Cons	.17
Overman	.04	MANHAT'N STOCKS	
Potosi	.09	Manhattan Cons.	.10
Savage	.30	Manhat'n Dexter.	.05
Sierra Nevada	.30	Jumping Jack	.04
Union	.23	Stray Dog	.04
Utah	.03	MISCELLANEOUS	
Yellow Jacket	.71	Golden Boulder	.07
TONOPAH STOCKS		Bonnie Clare	.08
Belmont	1.00	Lee Gold Grotto	...
Extension	.93¾	Nevada Hills	2.18¾
Golden Anchor	.01½	Nevada Smelting.	1.25
Jim Butler	.28	Pittsburgh S. Pk.	1.37
MacNamara	.26	Round Mt. Sphinx	‡.26
Midway	.40		
Montana	1.62		
North Star	.11		
Tono'h Mine of N.	7.75		
West End Con	.42		
GOLDFI'D STOCKS			
Adams	.04		
Atlanta	.20		
Booth	.19		
Columbia Mt.	.18		
Comb. Frac	.50		
Cracker Jack	.07		
Dia'dfield B. B. C.	.17		
Goldfield Belmont	.15		
Goldfield Daisy	1.16		
Great Bend	.29		
Jumbo Extension	.30		
Katherine	...		
Kendall	.18		
Lone Star	.08		
May Queen	.06		
Oro	.09		
Red Hill	.20		
Roanoke	...		
Sandstorm	.24		

COLO. SPRINGS	May 16
Name of Comp.	Clg.
Acacia	6½
Black Bell	....
C. C. Con	3½
Dante	8
Doctor Jack Pot	7½
Elkton	58½
El Paso	40
Findlay	22½
Gold Dollar	6¾
Gold Sovereign	3¾
Isabella	35½
Index	....
Jennie Sample	3½
Jerry Johnson	....
Mary McKinney	30
Pharmacist	3¼
Portland	1.01
Un. Gold Mines	4¼
Vindicator	85
Work	10½

New Dividends

Company.	Payable.	Rate.	Amt.
Alaska Mexican	Apr. 28	$0.50	$ 90,000
Alaska Treadwell	Apr. 28	0.75	150,000
Amalgamated	May 25	0.50	765,439
Am. Smelters, pfd.A	June 1	1.50	225,000
Am. Smelters, pfd.B	June 1	1.25	375,000
Bunker Hill & Sullivan	May 4	0.25	75,000
Calumet & Arizona	Apr. 25	1.00	200,000
Consolidation Coal	Apr. 30	1.50	153,750
Elkton	Apr. 24	0.01	37,500
Gen. Chemical, com	June 1	1.00	74,103
Hecla	Apr. 20	0.01	10,000
Homestake	May 25	0.50	109,200
Inter. Nickel, pfd.	May 1	1.50	131,123
Lehigh Coal & Nav.	May 27	2.00	639,802
National Lead, pfd.	June 15	1.75	260,820
Nipissing	Apr. 20	0.15	180,000
N. Y. & Hond. Rosario	May 29	0.10	15,000
Ophir	May	0.10	10,080
Quincy	June	1.00	110,000
Silver Queen	May 15	0.05	75,000
Sloss. Sheff., pfd	July 1	1.75	117,250
Standard Oil	June 15	9.00	8,730,000
U. S. Steel, com	June 30	0.50	2,541,513
U. S. Steel, pfd	June 1	1.75	6,305,497
Vindicator	Apr. 25	0.04	60,000

Assessments

Company.	Delinq.	Sale.	Amt.
Andes, Nev.	Apr. 23	May 15	$0.10
Belcher, Nev.	Apr. 29	May 20	0.10
Big Creek, Ida	Apr. 17	May 16	0.01
Brunswick Con., Cal.	May 27	June 26	0.03
Butler-Liberal, Utah	Apr. 25	May 13	0.02
Century, Utah	Apr. 14	May 14	0.02
Charm, Utah	Apr. 31	May 13	0.01
Federal	Apr. 25	May 18	0.05
Jenny Lind, Cal.	May 11	May 28	0.05
New Red Wing, Utah	May 2	May 19	0.01
Old Evergreen	Apr. 14	May 14	0.01
Oro Cobre, Cal.	Apr. 17	May 16	0.02
Posey Canyon, Cal.	Apr. 28	May 16	0.02
Potosi, Nev.	Apr. 20	May 3	0.10
Silver Bell, Utah	Apr. 10	Apr. 27	0.01
Wabash, Utah	May 9	June 1	0.10
Washakie-Nev., Nev.	Apr. 20	May 7	0.15
Western Mines, Nev.	Mar. 16	Apr. 23	0.01½
Zeibright, Cal.	May 12	June 1	0.05

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.981	.....	30.471	.....
June	67.090	.....	30.893	.....
July	68.144	.....	31.366	.....
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	.....	25.072	.....	102.375	.....
June	22.665	.....	24.140	.....	97.272	.....
July	21.130	.....	21.923	.....	95.016	.....
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	.....
February	42.102	28.978	August	37.667	.....
March	41.313	30.577	September	36.689	.....
April	40.938	31.702	October	32.620	.....
May	43.149	.....	November	30.833	.....
June	42.120	.....	December	27.925	.....
			Av. year	38.166	.....

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	.....	19.688	.....
June	5.760	.....	20.188	.....
July	5.288	.....	20.350	.....
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	.....	6.291	.....	25.563	.....
June	6.419	.....	6.269	.....	25.469	.....
July	6.072	.....	5.922	.....	23.850	.....
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Metal and Mining Companies—U. S.

Name of Company and Location.		Author-ized Capital	Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Alaska Mexican, g.	Al'ka	$1,000,000	180,000	$ 5	$1,896,381	Apr. 1908	$ .50
Alaska Treadwell, g.	Al'ka	5,000,000	200,000	25	9,935,000	Apr. 1908	.75
Alaska United, g.	Al'ka	1,000,000	180,200	5	333,370	Jan. 1908	.15
Amalgamated, c.	Mont	155,000,000	530,879	100	56,718,304	May 1908	.50
Am.Sm.&Ref.,com.	U. S.	50,000,000	500,000	100	13,125,000	Apr. 1908	1.00
Am. Sm. & Ref. pf.	U. S.	50,000,000	500,000	100	27,088,053	Apr. 1908	1.75
Am. Smelters, pf. A	U. S.	17,000,000	170,000	100	2,705,000	June 1908	1.50
Am. Smelters. pf. B	U. S.	30,000,000	300,000	100	4,500,000	June 1908	1.25
Am.Zinc,Lead&Sm.	Kan.	3,750,000	80,000	25	280,000	Nov. 1907	.50
Anaconda,c.	Mont	30,000,000	1,200,000	25	39,650,000	Apr. 1908	.50
Arizona, c.	Ariz	3,775,000	1,682,520	.....	6,182,361	Apr. 1906	.05
Atlantic, c.	Mich	2,500,000	100,000	25	990,000	Feb. 1905	.02
Bald Butte, g. s.	Mont	250,000	250,000	1	1,354,648	Oct. 1907	.04
Beck Tunnel, g.s.l.	Utah	100,000	1,000,000	0.10	675,000	Oct. 1907	.02
Bingham & N.H.,c.g	Utah	2,000,000	226,000	5	22,600	Sept. 1906	.10
Boston & Montana.	Mont	3,750,000	150,000	25	49,675,000	Apr. 1908	3.00
Bull.Beck.&Cham.g	Utah	1,000,000	100,000	10	2,688,400	Apr. 1907	.10
Bunker Hill & Sull.	Ida	3,000,000	300,000	10	10,146,000	May 1908	.25
Butte Coalition,c.s.	Mont	15,000,000	1,000,000	15	2,450,000	Dec. 1907	.15
Calumet & Arizonac	Ariz	2,500,000	200,000	10	9,500,000	Apr. 1908	1.00
Calumet & Hecla,c.	Mich	2,500,000	100,000	25	106,350,000	Mar. 1908	5.00
Camp Bird, g., s.	Colo	5,500,000	820,000	5	5,229,673	Mar. 1908	.48
Carisa, c.g.	Utah	500,000	500,000	1	55,000	Nov. 1906	.01
Colorado, l. g. s.	Utah	200,000	1,000,000	0.20	670,000	Jan. 1908	.05
Columbus Con. c.	Utah	1,500,000	283,540	5	226,832	Oct. 1907	.20
Combi'tion Co.G'f'd	Nevada	400,000	320,000	1	688,000	Sept. 1906	.15
Con. Mercur, g.	Utah	1,000,000	1,000,000	1	3,385,313	Dec. 1906	.02½
Continental, z.l.	Mo.	550,000	22,000	25	220,000	Oct. 1907	.50
Copper Range Con.	Mich	38,500,000	383,781	100	6,861,582	Apr. 1908	1.00
Creede United, g.	Colo.	2,000,000	1,625,000	1	214,063	July 1906	.00½
Daly Judge, g. s. l.	Utah	300,000	300,000	1	225,000	Apr. 1907	.37½
Daly West, g. s. l.	Utah	3,600,000	180,000	20	5,877,000	Dec. 1907	.30
De Lamar, g. s.	Ida	400,000	67,180	5	2,926,370	May 1905	.72
Dillon, g.	Colo.	1,250,000	1,250,000	1	21,875	July 1905	.01
Doctor Jack Pot.	Colo.	3,000,000	3,000,000	1	277,000	June 1906	.00½
Doe Run, l.	Mo.	10,000,000	59,062	100	1,523,631	Mar. 1908	.50
Elkton Con., g.	Colo.	3,000,000	2,500,000	1	2,079,461	Apr. 1908	.01½
El Paso, g.	Colo.	2,500,000	2,450,000	1	1,022,750	June 1906	.01
Fed. Sm., com.	Idaho	10,000,000	60,000	100	2,708,750	Mar. 1908	1.50
Federal Sm., pf.	Idaho	20,000,000	120,000	100	3,491,250	Mar. 1908	1.75
Findley, g.	Colo.	1,250,000	1,250,000	1	337,500	Sept. 1906	.01
Florence, g.	Nevada	1,250,000	1,050,000	1	210,000	Apr. 1908	.10
Frances-Mohawk, g	Nevada	1,000,000	910,000	1	410,000	Jan. 1908	.05
Gemini-Keystone	Utah	500,000	5,000	100	1,950,000	July 1907	10.00
Gold King Con	Colo.	5,750,370	5,750,370	1	1,407,504	May 1905	.01
Goldfield Con., g.	Nevada	50,000,000	5,000,000	10	1,000,000	Nov. 1907	.10
Grand Central, g.	Utah	250,000	250,000	1	1,333,000	Oct. 1907	.05
Gwin Mine, Dev., g.	Cal	1,000,000	100,000	10	496,000	Apr. 1906	.05
Hecla, s. l.	Idaho	250,000	1,000,000	0.25	1,560,000	Apr. 1908	.01
Homestake, g.	S. D.	22,000,000	218,400	100	22,750,040	May 1908	.50
HornSilver,g.s.c.z.l	Utah	10,000,000	400,000	25	5,642,000	Sept. 1907	.05
Inter'l Nickel, pf.	N. Y.	12,000,000	89,126	100	1,336,890	May 1908	1.50
Iron Silver	Colo.	10,000,000	500,000	20	4,100,000	Oct. 1907	.10
Jamison, g.	Cal	3,900,000	390,000	10	301,870	Apr. 1908	.02
Jerry Johnson.	Cal	2,500,000	2,500,000	1	86,700	Jan. 1908	.01
Kendall, g.	Mont	2,500,000	500,000	5	1,205,000	Feb. 1908	.02
Liberty Bell,g. s.	Colo.	700,000	130,551	5	130,440	Jan. 1907	.15
Lightner, g.	Cal	125,000	102,255	1	253,081	Oct. 1906	.05
Lower Mammoth, g	Utah	190,000	190,000	1	42,750	Aug. 1907	.07½
Mammoth, g. s. l.	Utah	10,000,000	400,000	2.50	2,220,000	Mar. 1908	.05
Mary McKinney, g.	Colo.	1,500,000	1,304,252	1	801,765	Apr. 1907	.03
May Day, g. s. l.	Utah	800,000	800,000	1	70,010	Oct. 1907	.01½
Mohawk, c.	Mich	2,500,000	100,000	25	1,400,000	July 1907	5.00
Mont. Ore Purch.	Mont	2,500,000	80,833	25	9,437,274	Jan. 1907	15.00
Nevada Hills, s.g.	Nevada	5,000,000	746,000	5	373,000	Dec. 1907	.10
New Century, z., l.	Mo.	300,000	300,000	1	230,300	Aug. 1907	.00½
Newhouse M. & S.c.	Utah	6,000,000	600,000	10	300,000	Sept. 1907	.50
New Idria, q.	Cal	500,000	100,000	5	990,000	Apr. 1908	.30
New Jersey Zinc	U. S.	10,000,000	100,000	100	8,400,000	Feb. 1906	3.00
North Butte	Mont	6,000,000	400,000	15	5,200,000	Sept. 1907	2.00
North Star, g.	Cal	2,500,000	250,000	10	1,599,489	Mar. 1908	.25
Old Dominion, c.	Ariz.	8,750,000	293,245	25	574,088	Aug. 1907	1.00
OldDominion,M&Sc	Ariz.	5,000,000	162,000	25	202,500	Aug. 1907	1.25
Old Gold	Colo.	2,101,150	2,101,150	1	10,506	Mar. 1906	.05
Ophir, g. s.	Nevada	302,400	100,800	3	1,806,280	May 1908	.10
Osceola, c.	Mich	2,500,000	96,150	25	7,035,650	July 1907	7.00
Parrot, c,s.	Mont	2,300,000	229,850	10	6,807,649	Sept. 1907	.25
Pennsylvania, g.	Cal	5,150,000	51,500	100	284,925	July 1905	.10
Pitts. L. & Z., l.z.	Mo	1,000,000	1,000,000	1	20,000	July 1907	.02
Portland, g.	Colo.	3,000,000	3,000,000	1	7,876,080	Apr. 1908	.04
Quartette, g. s.	Nevada	1,000,000	100,000	10	375,000	July 1907	.20
Quincy, c.	Mich	3,750,000	110,000	25	18,230,000	June 1908	1.00
Rocco Homest'k,l.s.	Nevada	300,000	300,000	1	112,000	Dec. 1905	.02
Sacramento, g, q.	Utah	1,000,000	1,000,000	1	258,000	Nov. 1906	.00½
St. Joseph, l.	Mo.	20,000,000	1,000,000	10	5,708,357	Mar. 1908	.15
Silver Hill, g. s.	Nevada	108,000	108,000	1	81,000	June 1907	.05
Silver King, g. s. l†	Utah	3,000,000	150,000	20	11,187,500	July 1907	.33½
Silver King Co't'n.†	Utah	6,250,000	1,250,000	5	375,000	Oct. 1907	.15
Shannon, c.	Ariz.	3,000,000	300,000	10	450,000	July 1907	.50
Snowstorm, s. l.	Ida	1,500,000	1,500,000	1	450,000	Sept. 1907	.03
Standard Con., g. s.	Cal	2,000,000	178,394	10	5,158,452	Dec. 1907	.10
Stratton'sIndepend	Colo.	5,500,000	1,000,007	5	4,895,865	Apr. 1906	.12½
Swansea, g. s. l.	Utah	500,000	100,000	5	329,500	Mar. 1907	.05
Tamarack, c.	Mich	1,500,000	60,000	25	9,420,000	July 1907	4.00
Tennessee, c.	Tenn	5,000,000	200,000	25	1,806,250	Feb. 1908	1.25
Tomboy, g. s.	Colo.	1,750,000	300,000	5	900,000	June 1906	.48
Tonopah of Nev.	Nevada	1,000,000	1,000,000	1	3,500,000	Oct. 1907	.25
Tonopah Belmont.	Nevada	2,000,000	1,295,007	1	518,003	Apr. 1907	.10
Tonopah Ext'nsion	Nevada	1,000,000	928,433	1	283,030	Apr. 1906	.15
Tonopah Midway.	Nevada	1,000,000	1,000,000	1	250,000	Jan. 1907	.05
Uncle Sam, g.s.l.	Utah	500,000	500,000	1	200,000	Dec 1907	.03
United States, com.	Utah	37,500,000	350,933	50	1,271,698	Apr. 1908	.50
United States, pfd.*	Utah	37,500,000	485,845	50	3,606,043	Apr. 1908	.87½
United Cop. com.	Mont	75,000,000	450,000	100	5,962,500	Aug. 1907	1.75
United, c. pf.	Mont	5,000,000	50,000	100	1,500,000	May 1907	3.00
United, z. l., pf.	Mo.-Kan.	500,000	19,556	25	303,006	Oct. 1907	.50
United Verde, c.	Ariz.	3,000,000	300,000	10	19,935,322	Mar. 1908	.75
U.S. Red. & Ref. Pf.	Colo.	4,000,000	39,458	100	1,360,294	Oct. 1907	1.50
Utah, g.(Fish Sp'gs)	Utah	1,000,000	100,000	10	300,000	Apr. 1908	.03
Utah Con., c.	Utah	1,500,000	300,000	5	7,836,000	Apr. 1908	.50
Victoria, Utah	Utah	250,000	250,000	1	177,500	Mar. 1907	.04
Vindicator Con., g.	Colo.	1,500,000	1,500,000	1	1,830,000	Apr. 1908	.04
Wolverine, c.	Mich	1,500,000	60,000	25	4,800,000	Apr. 1908	5.00
Work, g.	Colo.	1,500,000	1,500,000	1	165,000	Apr. 1908	.01
YankeeCon	Utah	500,000	500,000	1	157,500	Oct. 1907	.03
Yellow Aster, g.	Cal	1,000,000	100,000	10	958,789	Aug. 1907	.20

*Previous to consolidation $1,436,250 were divided. †Amalgamated.

Coal, Iron and Other Industrials—United States.

Name of Company and Location.		Author. ized Capital.	Shares. Issued.	Par Val. $	Dividends. Total to Date.	Latest. Date.	Amt.
Ala. Con., C. & I., pf.	Ala	$2,500,000	24,638	100	$905,265	May 1905	$1.75
Allis-Chalmers, pf.	U S	25,000,000	200,000	100	3,213,750	Feb. 1904	1.75
Amer. Ag. Chem., pf.	U. S	20,000,000	181,530	100	9,002,752	Apr. 1908	3.00
American Cement	Pa.	2,000,000	200,000	10	1,168,000	Jan. 1908	.30
American Coal	Md	1,500,000	50,000	25	2,367,500	Sept. 1907	1.25
Associated Oil	Cal	21,000,000	21,000,000	1	630,000	Aug. 1905	.01
Bethlehem Steel, pf.	Pa.	15,000,000	150,000	100	900,000	Nov. 1906	.75
Cambria Steel	Pa.	50,000,000	900,000	50	9,337,500	Feb. 1908	.75
Caribou Oil	Cal	100,000	80,000	1	56,000	July 1905	.07
Central C. & C., com.	Mo	5,125,000	51,250	100	2,229,375	Apr. 1908	1.50
Central C. & C., pf.	Mo	1,875,000	18,750	100	1,359,378	Apr. 1908	1.25
Central Oil	W. Va.	1,500,000	60,000	25	182,500	May 1904	.25
Claremont Oil	Cal.	500,000	450,000	1	58,500	June 1905	.01
Col. & Hock. C. & I,pf.	Ohio	7,000,000	69,244	100	383,818	Apr. 1908	1.50
Consolidated Coal	Ill.	5,000,000	50,000	100	350,000	July 1904	1.00
Consolidation Coal	Md.	10,250,000	102,500	100	9,621,650	Jan. 1908	3.50
Crucible Steel, pf.	Pa.	25,000,000	250,000	100	2,125,000	June 1907	1.50
Empire S. & I., pf.	N. J.	2,500,000	25,000	100	820,533	Jan. 1908	3.00
Fairmont Coal,	W. Va.	12,000,000	120,000	100	2,100,000	Jan. 1908	2.00
Four Oil	Cal.	500,000	300,000	1	105,406	July 1905	.01
General Chem. Com.	U. S.	12,500,000	74,103	100	2,115,640	June 1908	1.00
General Chem., pf.	U. S.	12,500,000	100,000	100	5,140,178	Apr. 1908	1.50
George's C'k Coal	Md	2,500,000	22,000	100	1,188,000	July 1904	3.00
Imperial Oil	Cal.	1,000,000	100,000	100	880,000	July 1905	.20
International Salt.	Penn.	30,000,000	182,280	100	927,060	Dec. 1906	1.00
Jeff. & Cl'f C. & I., cm	Pa.	1,500,000	15,000	100	330,000	Aug. 1905	5.00
Jeff. & Cl'f. C. & I., pf	Pa.	1,500,000	15,000	100	938,000	Feb. 1908	2.50
Kern River Oil	Cal.	2,000,000	20,000	100	39,500	May 1905	.13
Lehigh Coal & Nav.	Pa.	17,378,500	346,901	50	27,002,297	May 1908	2.00
Maryland Coal, pf.	Md.	2,000,000	18,850	100	1,667,960	Jan. 1908	4.00
Monon R. Coal, pf.	Pa.	10,000,000	100,000	100	3,854,945	Jan. 1908	3.50
National Carbon, pf.	U. S.	4,500,000	45,000	100	2,047,500	May 1905	1.75
National Lead, com.	N. Y.	15,000,000	149,054	100	2,533,919	Apr. 1908	1.25
National Lead, pf.	N. Y.	15,000,000	149,040	100	17,111,788	Mar. 1908	1.75
Nat'l Steel & Wire,pf.	N. Y.	5,000,000	25,778	100	631,561	May 1906	1.75
New Central Coal	Md.	1,000,000	50,000	20	350,000	May 1907	.40
New River Coal, pfd.	W. Va.	4,000,000	37,617	100	225,702	Nov. 1907	1.50
Pacific Coast Borax	Cal.	2,000,000	19,000	100	2,086,500	Aug. 1905	1.00
Peerless Oil	al.	1,000,000	92,000	10	396,320	May 1905	.14
Penna. Salt	Pa.	3,000,000	60,000	50	14,918,000	Apr. 1908	3.00
Penna. Steel, pfd.	Pa.	25,000,000	168,214	100	8,204,493	Nov. 1907	3.50
Phila. Gas, com	Pa.	28,953,029	579,061	50	8,484,336	Nov. 1907	.75
Phila. Gas, pf.	Pa.	6,000,000	120,000	50	2,700,000	Mar. 1908	1.25
Pittsburg Coal, pf.	Pa.	32,000,000	297,010	100	11,434,962	Apr. 1905	1.75
Pocahontas Coll., pf.†	W. Va.	2,800,000	28,000	100	84,000	Jan. 1908	3.00
Pocahontas Coll.,cm†	W. Va.	4,520,000	45,200	100	135,600	Oct. 1907	3.00
Republic I. & S., pfd.	Ill.	25,000,000	204,169	100	6,045,338	Apr. 1908	1.75
Sloss-Sheffield, com.	Ala	10,000,000	100,000	100	1,625,000	Mar. 1908	1.25
Sloss-Sheffield, pf.	Ala	10,000,000	67,000	100	3,634,750	July 1908	1.75
Standard Oil	U. S.	100,000,000	970,000	100	614,002,905	June 1908	9.00
Tenn. C. & I., com	Tenn	22,553,600	225,536	100	3,583,060	Nov. 1907	1.00
Tenn. C. & I., pf.	Tenn	248,000	2,480	100	390,040	Nov. 1907	2.00
Texas & Pacific Coal.	Texas.	2,500,000	23,940	100	1,663,830	Dec. 1908	1.50
United Metals Selling	U. S.	5,000,000	50,000	100	5,125,000	Apr. 1908	5.00
U. S. SteelCorp.,cm.	U. S.	550,000,000	5,083,025	100	73,666,079	June 1908	.50
U. S. Steel Corp., pf.	U. S.	360,281,100	3,603,141	100	206,371,215	May 1908	1.75
Va. Carolina Ch., pf.	U. S.	20,000,000	180,000	100	13,260,869	Apr. 1908	2.00
Warwick I. & S.	U. S.	1,500,000	145,581	1	473,138	Nov. 1907	.30
Westmoreland Coal.	Pa.	3,000,000	60,000	50	8,730,000	Apr. 1908	2.50

Canada, Mexico, Central and South America.

Name of Company and Location.		Author-ized Capital.	Shares. Issued.	Par Val. $	Dividends. Total to Date.	Latest. Date.	Amt.
Amistad y Conc'rdia.	Mex.	$480,000	9,600	50	$258,064	Jan. 1905	$1.71
Batopilas	Mex.	9,000,000	446,268	20	† 55,784	Dec. 1907	.12½
British Columbia, c.	B. C.	3,000,000	503,000	5	201,200	Sept. 1907	.40
Buffalo, s.	Ont.	1,000,000	900,000	100	189,000	Apr. 1908	.08
Butters' Salvador, g.	Salv	750,000	150,000	5	600,000	Apr. 1905	.25
Coniagas (Cobalt)	Ont.	4,000,000	800,000	5	600,000	May 1908	.10
Consolidated M & S.	B. C.	5,500,000	53,552	100	781,885	Nov. 1907	1.25
Crow's Nest Pass	B. C.	4,000,000	160,000	25	2,018,648	July 1907	.62½
Dominion Coal, com.	N. S.	15,000,000	150,000	100	2,700,000	Apr. 1908	1.00
Dominion Coal, pf.	N. S.	3,000,000	30,000	100	‡630,000	Feb. 1908	3.50
Dos Estrellas, g. s.	Mex	150,000	3,000	50	1,020,555	July 1905	13.65
El Oro, g. s.	Mex	5,750,000	1,080,000	5	4,600,800	Jan. 1908	.36
Esperanza, s. g.	Mex	2,275,000	455,000	5	8,426,150	Apr. 1908	1.09
Foster Cobalt, s.	Ont.	1,000,000	1,000,000	1	50,000	Jan. 1907	.05
Granby Con.	B. C.	15,000,000	135,000	100	2,968,630	Sept. 1907	3.00
Greene Con. Copper.	Mex.	8,640,000	864,000	10	6,137,800	Mar. 1907	.40
Greene Con. Gold.	Mex.	5,000,000	500,000	10	300,000	July 1905	.20
GreenGold-Silv'r,pfd.	Mex.	3,000,000	300,000	10	120,000	Mar. 1907	.40
Guanajuato	Mex.	3,000,000	540,000	5	74,250	Oct. 1906	.07
Guggenheim Expl.	Mex.	17,000,000	105,000	100	4,222,500	Apr. 1908	2.50
Hinds Con., g.s.c.l.	Mex.	5,000,000	5,000,000	1	100,000	Feb. 1908	.02
Kerr Lake, s.	Ont.	3,000,000	600,000	5	570,000	Apr. 1908	.15
LeRoi No. 2, g.	B. C.	3,000,000	120,000	25	774,000	Mar. 1908	.48
McKinley-Darragh,s.	Ont.	2,500,000	2,000,000	1	180,000	Jan. 1908	.04
Mexican Coal & Coke	Mex.	5,000,000	50,000	100	600,000	Dec. 1905	3.00
Mex. Con. M. & S. Co.	Mex.	2,500,000	240,000	10	660,000	Mar. 1908	.25
Mines Co. of Am.	Mex.	2,000,000	2,000,000	1	3,025,000	Mar. 1908	.02
N. Y. & Hond. Ros.	C. A.	1,500,000	150,000	10	2,712,000	May 1908	.10
Nipissing, s.	Ont.	6,000,000	1,200,000	5	1,680,000	Apr. 1908	.15
North Star.	B. C.	1,500,000	1,300,000	1	351,000	Dec. 1904	1.00
N. S. St. & Coal, com.	N. S.	5,000,000	49,876	100	1,087,856	Apr. 1908	1.50
N. S. St. & Coal, pf.	N. S.	1,030,000	10,300	100	437,750	Apr. 1908	2.00
Penoles*	Mex.	250,000	2,500	100	8,630,000	Dec. 1907	20.00
Platanillo	Mex.	500,000	206,989	1	5,580	Sept. 1906	.00
Reco, g. s. l.	B. C.	1,000,000	958,000	1	327,082	Apr. 1906	.02
Silver Queen, s.	Ont.	1,500,000	1,500,000	1	195,000	May 1908	.05
Slocan Star.	B. C.	500,000	500,000	1	575,000	Dec. 1904	.05
Tezuitlan Copper	Mex.	1,000,000	10,000	100		Apr. 1908	1.50
Tilt Cove, c.	N. F.	1,000,000	89,000	2	21,360	Jan. 1905	.48
Tretheway, s.	Ont.	1,000,000	1,000,000	1	80,000	Mar. 1907	.04
Tyee, c.	B. C.	940,000	180,000	5	136,800	Dec. 1904	.24

*Mexican Currency. †Since reorganization. ‡Since August, 1905.